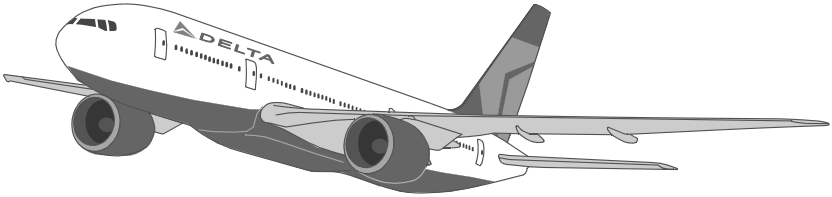
DELTA



777-232ER/LR

Operations Manual Volume 1

Delta Air Lines, Inc.

REVIEWED BY:

Roger Pfannenstiel
777 - Technical Manager

APPROVED BY:

Warren Abrams
777- Chief Line Check Pilot

APPROVED BY:

Jon Swift
777 - Fleet Captain

Revision Number 18
Revision Date: February 15, 2008

© 2008 Delta Air Lines, Inc.

Preface — Chapter P1
Table of Contents — Section 0

Volume 1 **Chapter**

Copyright © Delta Air Lines, Inc. See title page for details.

Intentionally
Blank

Copyright © Delta Air Lines, Inc. See title page for details.

General

The airplanes listed in the table below are covered in the operations manual. The numbers are used to distinguish data peculiar to one or more, but not all of the airplanes. Where data applies to all airplanes listed, no reference is made to individual airplane numbers.

The table permits flight crew correlation of configuration differences by Registry Number in alpha/numeric order within an operator's fleet for airplanes covered in this manual. Configuration data reflects the airplane as delivered configuration and is updated for service bulletin incorporations in conformance with the policy stated in the introduction section of this chapter.

Airplane number is supplied by the operator. Registry number is supplied by the national regulatory agency. Serial and tabulation numbers are supplied by Boeing.

Ship Number	Registry Number	Serial Number	Tabulation Number
7001	N860DA	29951	WB446
7002	N861DA	29952	WB447
7003	N862DA	29734	WB448
7004	N863DA	29735	WB449
7005	N864DA	29736	WB450
7006	N865DA	29737	WB451
7007	N866DA	29738	WB452
7008	N867DA	29743	WB453
7101	N701DN	29740	WD066
7102	N702DN	29741	WD067
And Subsequent			

Copyright © Delta Air Lines, Inc. See title page for details.

Intentionally
Blank

Copyright © Delta Air Lines, Inc. See title page for details.

General

Purpose

The Boeing Company developed normal and non-normal procedures for the 777 aircraft. Delta Air Lines, Inc. has modified some of the procedures for simplification and standardization, when appropriate, with other Delta Air Lines, Inc. aircraft. Finally, the FAA has approved the procedures presented in the Operations Manual, with the exception of flight crew bulletins.

These procedures are company policy for pilots to follow during ground operations and in flight. Deviations from these policies and procedures should be made only with good cause and based on the safest course of action. The Captain's best judgement must be applied if an abnormality occurs that is not covered by these procedures.

Manual Rights

The B-777 Operations Manuals have been prepared for the exclusive use of Delta Air Lines. Flight Operations personnel under the direction and authority of Delta Air Lines and shall, at all times, remain the property of Delta Air Lines. The holder hereof acknowledges and agrees that this manual contains or may contain trade secrets, copyrighted material and commercial and proprietary information, privileged and confidential, to the interest of Delta, and the holder hereof further agrees that this manual may not be reproduced, distributed or copied, in whole or in part, without the express prior written consent of Delta Air Lines.

- In the event this B-777 Operations Manual is sold or distributed to any other party, no warranty or guarantee, expressed or implied, is made as to the accuracy, sufficiency or suitability of the materials contained herein or of any revision, supplement or bulletin hereto. It is understood and agreed to by such other party that it shall release indemnify and hold Delta Air Lines, its officers, employees and agents harmless against any and all claims or actions of whatever nature which may arise or claim to arise from the use hereof.

Copyright © Delta Air Lines, Inc. See title page for details.

Corrections to the Manual

To correct any errors or discrepancies discovered in this manual, or to submit a suggested change to any Aircraft Operating Manual (Volume 1, Volume 2, Quick Reference Handbook , Flight Crew Training Manual), Normal Checklist, Airway Manual, Flight Operations Manual (FOM), OE/TOE Guide, Flight Crew Bulletin (FCB), or Flight Operations Bulletin (FOB):

Log on to the Flight Operations Portal (http://dalweb.delta.com/portal) to submit a Publications Change Request (PCR).

There are links to the PCR form on each fleet page and also on the Flight Ops Manual/Library Services page.

Once submitted, the PCR is automatically routed to the applicable Fleet Technical Manager, Technical Writer, and Specialist for that manual.

Organization

The FCOM is organized in the following manner.

Volume 1 –

- Preface chapter contains general information regarding the manual's purpose, structure, and content. It also contains lists of abbreviations, a record of revisions, a list of effective pages, and bulletins.
- Limitations and Normal Procedures chapters cover operational limitations and normal procedures. All operating procedures are based on a thorough analysis of crew activity required to operate the airplane, and reflect the latest knowledge and experience available.
- Supplementary Procedures chapter covers those procedures accomplished as required rather than routinely on each flight.
- Differences chapter notes differences between aircraft types.

Volume 2 – Chapters 1 through 15 contain general airplane and systems information. These chapters are generally subdivided into sections covering controls and indicators and systems descriptions.

Quick Reference Handbook (QRH) – The QRH covers normal checklists, non–normal checklists, and maneuvers.

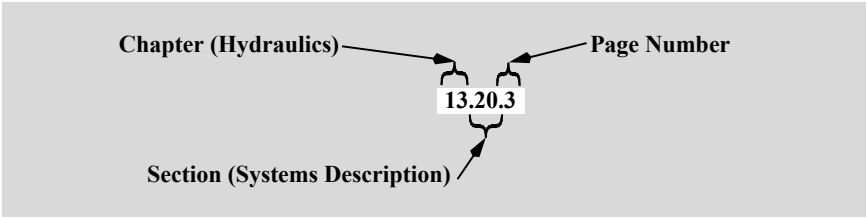
Flight Crew Training Manual (FCTM) - The Flight Crew Training Manual provides information and recommendations on maneuvers and techniques.

Copyright © Delta Air Lines, Inc. See title page for details.

Page Numbering

The Operations Manual uses a decimal page numbering system. The page number is divided into three fields; chapter, section, and page (except for the Flight Crew Training Manual which uses a two field numbering system). An example of a page number for the hydraulics chapter follows: chapter 13, section 20, page 3.

Example Page Number



Warnings, Cautions, and Notes

The following levels of written advisories are used throughout the FCOM and are not to be confused with EICAS messages, which are separately identified in the text.

WARNING: An operating procedure, technique, etc., that may result in personal injury or loss of life if not carefully followed.

CAUTION: An operating procedure, technique, etc., that may result in damage to equipment if not carefully followed.

Note: An operating procedure, technique, etc., considered essential to emphasize. Information contained in notes may also be safety related.

Airplane Effectivities

Differences in airplane configuration are shown by use of airplane effectivities throughout Volumes 1 and 2, Quick Reference Handbook, and the Flight Crew Training Manual. The following rules are used to express airplane effectivities:

- Airplane effectivities are listed by ship number. A range of airplanes is defined by a dash, e.g. Ships 7001 – 7008. A comma in the effectivity range indicates a break in the range, e.g. Ships 7001 – 7005, 7007 – 7008; airplane 7006 is excluded from the range. Airplanes introduced to fleet following manual publication are effective as subsequent ships, e.g. Ships 7101 & Subsequent.
- Airplane effectivities apply only to the paragraph, illustration, operational note, procedural step, etc. and to subordinate items (if any).

Continued on next page

Copyright © Delta Air Lines, Inc. See title page for details.

Continued from previous page

Example (with subordinate items):

Ships 7001 – 7008
CABIN CREW COMMUNICATIONS.....ESTABLISH
Evacuate lower crew rest compartment and close hatches.

Plan to land at the nearest suitable airport

In this example, the effectivity 7001 – 7008 applies to the first procedural step (CABIN CREW.....) and further indented/subordinate step (Evacuate....). The effectivity does not apply to the next equivalently indented step (Plan to land.....).

Example (without subordinate items):

Ships 7101 & Subsequent
NOTE: Slats will extend beyond midrange when airspeed is below 246 knots. For go-around, do not exceed 246 knots until slats retract to midrange.

NOTE: Use flaps 20 and VREF20 for landing.

In this example, the effectivity Ships 7101 & Subsequent applies to the first operational note only. The effectivity does not apply to the next equivalently indented note.

For clarity, an "All" effectivity may be applied to differentiate common steps from those effected by specific ship numbers.

When airplane effectivities are centered immediately below a checklist title, the entire checklist applies to the listed airplanes. In the following example, the PACK L, R checklist is applicable to Ships 7001 – 7008 only:

PACK L, R

Ships 7001 – 7008

Copyright © Delta Air Lines, Inc. See title page for details.

General

The following abbreviations may be found throughout the manual. Some abbreviations may also appear in lowercase letters. Abbreviations having very limited use are explained in the chapter where they are used. Since this list is compiled across several fleets, there may be some abbreviations that do not apply to this specific fleet.

A	
ABV	Above
AC	Alternating Current or Aircraft
ACARS	Aircraft Communications Addressing and Reporting System
ACE	Actuator Control Electronics
ACP	Audio Control Panel
ACT	Active
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADI	Attitude Director Indicator
ADIRS	Air Data Inertial Reference System
ADIRU	Air Data Inertial Reference Unit
ADM	Air Data Module
AED	Automatic External Defribulator
AFDC	Autopilot Flight Director Computer
AFDS	Autopilot Flight Director System
AFE	Above Field Elevation
AFM	Airplane Flight Manual (FAA approved)
AFM - DPI	Airplane Flight Manual - Digital Performance Information
AFS	Automatic Flight System (Autopilot or Autothrottle)
A/G	Air/Ground
AGL	Above Ground Level
AH	Alert Height
AHRS	Attitude Heading Reference System
AI	Anti-Ice
AIL	Aileron
ALFA	Safe Stall Margin Speed
ALT	Altitude
ALT ACQ	Altitude Acquire
ALT HOLD	Altitude Hold
ALTN	Alternate
AM	Amplitude Modulation

Copyright © Delta Air Lines, Inc. See title page for details.

AIMS	Airplane Information Management System
AMI	Airline Modifiable Information
ANP	Actual Navigational Performance
ANT	Antenna
ANU	Aircraft Nose Up
AOA	Angle of Attack
AOC	Airline Operational Communication Data Link
A/P	Autopilot
APL	Airplane
APP	Approach
APU	Auxiliary Power Unit
ARINC	Aeronautical Radio, Incorporated
ARM	Aircraft Restrictions Manual
ARPT	Airport
ARR	Arrival
ART	Automatic Reserve Thrust
ASA	Autoland Status Annunciator
ASI	Airspeed Indicator
ASR	Airport Surveillance Radar
ASYM	Asymmetry
A/T	Autothrottle
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATIS	Automated Terminal Information Service
ATM	Assumed Temperature Method
ATT	Attitude
AUTO	Automatic
AUTO–THROT	Autothrottle
AUX	Auxiliary
AVAIL	Available
AWABS	Automated Weight and Balance System

B	
BARO	Barometric
BAT	Battery
B/C or B/CRS or BAC or BCS	Back Course
BFO	Beat Frequency Oscillator
BITE	Built-In Test Equipment
BKR	Breaker
BLD	Bleed
BLW	Below
BRG	Bearing
BRT	Bright
BTL	Bottle
BTL DISCH	Bottle Discharge (fire extinguisher)
BTMS	Brake Temperature Monitoring System

C

Copyright © Delta Air Lines, Inc. See title page for details.

C	Captain or Celsius or Center or Cool
CAA	Civil Aviation Authority
CADC	Central Air Data Computer
CALSEL	Call Select
CANC/RCL	Cancel/Recall
CANPA	Constant Angle Non-Precision Approach
CAP	Capture
CAPT	Captain
CAWS	Central Aural Warning System
CB	Circuit Breaker
CCD	Cursor Control Device
CDS	Common Display System
CDU	Control Display Unit
CFIT	Controlled Flight Into Terrain
CG	Center of Gravity
CHKL	Checklist
CHR	Chronograph
CKD	Checked
CKT	Circuit
CL	Close
CLB	Climb
CLMP	Computer Lockout Manual Power
CLR	Clear
CMD	Command
CO	Company
COMM	Communication
COMP	Comparator
COMPT	Compartment
CON	Continuous
CONFIG	Configuration
CONT	Control
COOL	Cooling
CRS	Course
CRT	Cathode Ray Tube
CRZ	Cruise
CTL	Control
CTR	Center
CWS	Control Wheel Steering

D	
DA	Decision Altitude
DA(H)	Decision Altitude (Height)
DC	Direct Current
DCU	Display Concentrator Unit
D/D	Direct Descent
DDA	Derived Decision Altitude (MDA +50 feet)
DDG	Dispatch Deviations Guide
DEL	Delete
DEP	Departure
DEP ARR	Departure Arrival
DEPR	Depressurize
DES	Descent

Copyright © Delta Air Lines, Inc. See title page for details.

DEU	Display Electronic Unit
DFCS	Digital Flight Control System
DFGC	Digital Flight Guidance Computer
DFGS	Digital Flight Guidance System
DH	Decision Height
DIFF	Differential
DIR	Direct
DISC	Disconnect
DISCH	Discharge
DK	Deck
DME	Distance Measuring Equipment
DN	Down
DPC	Display Processing Computer
DSP	Display Select Panel
DSPL	Display
DTG	Distance to Go
DTW	Distance to Waypoint
DU	Display Unit

E	
EADI	Electronic Attitude Director Indicator
ECON	Economy
E/D	End of Descent
E/E	Electrical/Electronic
EEC	Electronic Engine Control
EFI	Electronic Flight Instruments
EFIS	Electronic Flight Instrument System
EGPWS	Enhanced Ground Proximity Warning System
EGT	Exhaust Gas Temperature
EHSI	Electronic Horizontal Situation Indicator
EICAS	Engine Indication and Crew Alerting System
EIS	Electronic Instrument System
ELEC	Electrical
ELEV	Elevator
EMER	Emergency
ENG	Engine
ENG OUT	Engine Out
ENT	Entry
EO or E/O	Engine Out
EOAP	Electronic Overhead Annunciation Panel
EPR	Engine Pressure Ratio
EQPT or EQUIP	Equipment
ER	Extended Range
ETOPS	Extended Range Operation with Twin Engine Airplanes
EVAC	Evacuation
EXEC	Execute
EXT	Extend or External

Copyright © Delta Air Lines, Inc. See title page for details.

F	
F	Fahrenheit
FAC	Final Approach Course
FAA	Federal Aviation Administration
FADEC	Full Authority Digital Engine Control
FAF	Final Approach Fix
FAR	Federal Aviation Regulation
FCB	Flight Crew Bulletin
FCC	Flight Control Computer
FCTL	Flight Control
FCTM	Flight Crew Training Manual
FD, F/D or FLT DIR	Flight Director
FF	Fuel Flow
FFM	Force Fight Monitor
FGCP	Flight Guidance Control Panel
FGS	Flight Guidance System
FILT	Filter
FIR	Flight Information Region
FL CH or FLCH	Flight Level Change
FLT	Flight
FLT CTRL	Flight Control
FLPRN	Flaperon
FMA	Flight Mode Annunciator
FMC	Flight Management Computer
FMS	Flight Management System
F/O or F O	First Officer
FOM	Flight Operations Manual
FPA	Flight Path Angle
FPM	Feet Per Minute
FPV	Flight Path Vector
FREQ	Frequency
F/S	Fast/Slow
FT	Feet
FWD	Forward
FWSOV	Fire Wall Shut Off Valve
FX	Fix

G	
GA	Go–Around
GE	General Electric
GEN	Generator
GLS	GPS Landing System
GMT	Greenwich Mean Time
GND	Ground
GP or G/P	Glide Path
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
GS	Ground Speed
G/S	Glide Slope
GW	Gross Weight

H

Copyright © Delta Air Lines, Inc. See title page for details.

HAA	Height Above Airport
HAT	Height Above Touchdown
HDG	Heading or Hydraulic Driven Generator
HDG REF	Heading Reference
HDG SEL	Heading Select
HF	High Frequency
HGS	Head-Up Guidance System (HGS® is a registered trademark of Flight Dynamics)
HI	High
HLD	Hold
HPA	Hectopascals
HPSOV	High Pressure Shut Off Valve
HSI	Horizontal Situation Indicator
HUD	Head-Up Display
HYD	Hydraulic

I	
IAF	Initial Approach Fix
IAN	Instrument Approach Navigation
IAS	Indicated Airspeed
IDENT	Identification
IFE	In-Flight Entertainment System
IFR	Instrument Flight Rules
IGN	Ignition
IGS	Instrument Guidance System
ILS	Instrument Landing System
IM	Inner Marker
IMC	Instrument Meteorological Conditions
IN	Inches
INBD	Inboard
IND	Indicator
IND LTS	Indicator Lights
INOP	Inoperative
INIT	Initialization
INSTR	Instrument
INT or INTPH	Interphone
INTC	Intercept
INTC CRS	Intercept Course
IP	Instructor Pilot
IRS	Inertial Reference System
IRU	Inertial Reference Unit
ISA	International Standard Atmosphere
ISDU	Inertial System Display Unit
ISFD	Intergrated Standby Flight Display
ISLN	Isolation

J	
JAA	Joint Aviation Authority

Copyright © Delta Air Lines, Inc. See title page for details.

K	
K or KTS	Knots
KCAS	Knots Calibrated Airspeed
KGS	Kilograms
KIAS	Knots Indicated Airspeed

L	
L	Left
LAT	Latitude
LBS	Pounds
LD	Load
LDA	Localizer-type Directional Aid
LDG	Landing
LDG ALT	Landing Altitude
LE	Leading Edge
LIM	Limit
LIM SPD	Limit Speed
LKD	Locked
L NAV or LNAV	Lateral Navigation
LOC	Localizer
LOC-BC	Localizer Back Course
LOM	Locator Outer Marker
LON	Longitude
LR	Long Range
LRC	Long Range Cruise
LRU	Line Replaceable Unit
LSK	Line Select Key
LT	Light
LWR CTR	Lower Center
LWR DSPLY or LWR DSPL	Lower Display

M	
M	Mach
MAG	Magnetic
MAHP	Missed Approach Holding Point
MAN	Manual
MAP	Missed Approach Point
MASI	Mach/Airspeed Indicator
MAX	Maximum
MCC	Maintenance Control Center
MCDU	Multi-purpose Control and Display Unit
MCO	Maintenance Carry Over
MCP	Mode Control Panel
MCT	Maximum Continuous Thrust
MDA	Minimum Descent Altitude
MDA(H)	Minimum Descent Altitude (Height)
MDM	Mechanical Dispatch Manual
MEA	Minimum Enroute Altitude
MEL	Minimum Equipment List
MFD	Multifunction Display
MHZ	Megahertz

Copyright © Delta Air Lines, Inc. See title page for details.

MIC	Microphone
MIN	Minimum
MKR	Marker
MLS	Microwave Landing System
MM	Middle Marker
MMO	Maximum Mach Operating Speed
MNPS	Minimum Navigation Performance Specification
MOCA	Minimum Obstruction Clearance Altitude
MOD	Modify
MORA	Minimum Off Route Altitude
MSA	Minimum Safe Alitude
MSG	Message
MSGS RCVD	Messages Received
MSL	Mean Sea Level
MTRS	Meters
MUH	Minimum Use Height

N	
N	Normal
NADP	Noise Abatement Departure Procedures
NAR	North American Route
NAV	Navigation
NAV RAD	Navigation Radio
ND	Navigation Display
NLT	No Later Than
NM	Nautical Mile(s)
NNC	Non-Normal Checklists
NNM	Non-Normal Maneuvers
NPS	Navigation Performance Scales
NORM	Normal
N1	Low Pressure Rotor Speed
N2	High Pressure Rotor Speed (Pratt & Whitney and GE engines) or Intermediate Pressure Rotor Speed (Rolls Royce Engines)
N3	High Pressure Rotor Speed (Rolls Royce Engines)

O	
OAP	Overhead Annunciator Panel (a.k.a. EOAP)
OAT	Outside Air Temperature
OCC	Operations Control Center
ODM	Operational Data Manual
OFST	Offset
OHU	Overhead Unit
OM	Outer Marker
OP	Open
OUTBD DSPL	Outboard Display
OVHD	Overhead
OVHT	Overheat
OVRD	Override
OVSPD	Overspeed

Copyright © Delta Air Lines, Inc. See title page for details.

OXY or O2	Oxygen

P	
PA	Passenger Address
PAPI	Precision Approach Path Indicator
PAR	Precision Approach Radar
PASS	Passenger
PBE	Protective Breathing Equipment
PCP	Pilot Call Panel
PDC	Pitch Data Computer or Performance Data Computer or Pre-Departure Clearance
PERF	Performance
PERF INIT	Performance Initialization
PES	Pitch Enhancement System
PF	Pilot Flying
PFC	Primary Flight Computer
PFD	Primary Flight Display
PI	Performance Inflight
PIP	Product Improvement Package
PM	Pilot Monitoring
PMC	Power Management Control
PNL	Panel
POS	Position
POS INIT	Position Initialization
POS REF	Position Reference
PPI	Planned Position Indicator
PPOS	Present Position
PRES or PRESS	Pressure
PREV	Previous
PRI	Primary
PROG	Progress
PROX	Proximity
P/RST	Push To Reset
PRV	Pressure Regulating Valve
PSI	Pounds Per Square Inch
PTH	Path
PTT	Push To Talk
PTU	Power Transfer Unit
PWR	Power
PWS	Predictive Windshear System

Q	
Q	Quantity
QFE	Local Station Pressure
QNH	Altimeter Setting
QRH	Quick Reference Handbook
QTY	Quantity

R	
R	Right

Copyright © Delta Air Lines, Inc. See title page for details.

RA	Radio Altitude or Resolution Advisory
RAD	Radio
RAT	Ram Air Temperature or Ram Air Turbine
RCL	Request for Clearance
RDMI	Radio Distance Magnetic Indicator
REC	Recorder
RECIR or RECIRC	Recirculation
REF	Reference
RET	Retract
REV	Reverse
RF	Radius-to-Fix (RF) Legs or Refill
RMI	Radio Magnetic Indicator
RNAV or RNV	Area Navigation
RNP	Required Navigational Performance
RPL	Rudder Pressure Limiter
RPM	Revolutions Per Minute
RPR	Rudder Pressure Reducer
RR	Rolls Royce
RSEP	Rudder System Enhancement Program
RST	Reset
RSVR	Reservoir
R/T	Radio Transmit
RTE	Route
RTO	Rejected Takeoff
RTP	Radio Tuning Panel
RUD	Rudder
RVR	Runway Visual Range
RVSM	Reduced Vertical Separation Minimum

S	
SAARU	Secondary Attitude Air Data Reference Unit
SAT	Static Air Temperature or Satellite
SB	Service Bulletin
S/B	Speedbrake
S/C	Step Climb
SDF	Simplified Directional Facility
SEI	Standby Engine Indicator
SEL	Select
SELCAL	Selective Calling
SENS	Sensitivity
SERV	Service
SG	Symbol Generator
SPD	Speed
SPDBRK	Speedbrake
STA	Station
STAB	Stabilizer
STAT	Status
STBY	Standby
STD	Standard
SYS	System

T

Copyright © Delta Air Lines, Inc. See title page for details.

T or TRU	True
T or TK or TRK	Track (to a Navaid)
TA	Traffic Advisory
TAA	Terminal Arrival Area
TACAN	Tactical Air Navigation
TAC	Thrust Asymmetry Compensation
TAI	Thermal Anti–Ice
TAS	True Airspeed
TAT	Total Air Temperature
T/C	Top of Climb
TCA	Terminal Control Area
TCAS	Traffic Alert and Collision Avoidance System
T/D	Top of Descent
TDZ	Touch Down Zone
TDZE	Touch Down Zone Elevation
TE	Trailing Edge
TEMP	Temperature
TERR	Terrain
TFC	Traffic
TFR	Transfer
THR	Throttle or Thrust
THR HOLD	Throttle Hold
TMC	Thrust Management Computer
TMI	Track Message Identifier
TMSP	Thrust Mode Select Panel
TO or T/O	Takeoff
TOC	Top of Climb
TOD	Top of Descent
TO/GA	Takeoff/Go–Around
TR	Traffic Resolution
TRP	Thrust Rating Panel
TRU	Transformer Rectifier Unit
TURB	Turbine or Turbulence

U	
UNLKD	Unlocked
UNSCHD or UNSCHED	Unscheduled
UPR DSPL	Upper Display
U.S.	United States
USB	Upper Side Band
UTC	Universal Time Coordinated
UTIL	Utility

V	
VA	Design maneuvering speed
VAL	Valve
VANP	Vertical Actual Navigational Performance
VASI	Visual Approach Slope Indicator
VDP	Visual Descent Point
VEF	Speed at Engine Failure

Copyright © Delta Air Lines, Inc. See title page for details.

VERT	Vertical
VFR	Visual Flight Rules
VG	Vertical Gyro
VHF	Very High Frequency
VIB	Vibration
VLV	Valve
VMC	Visual Meteorological Conditions
VMCA	Minimum Control Speed Air or Single Engine Minumum Control Airspeed
VMCG	Minimum Control Speed Ground
VMO	Maximum Operating Speed
V NAV or VNAV	Vertical Navigation
VOR	VHF Omnidirectional Range
VR	Rotation Speed
VREF	Reference Speed
VRNP	Vertical Required Navigation Performance
V/S	Vertical Speed
VSCF	Variable Speed Constant Frequency
VSD	Vertical Situation Display
VSI	Vertical Speed Indicator
VTK	Vertical Track
V1	Takeoff Decision Speed
V1 (MCG)	Minimum V1 for Control on the Ground
V2	Scheduled Takeoff Target Speed

W	
W	Warm
WATRS	Western Atlantic Route System
WDR	Weight Data Record
WGS-84	World Geodetic System of 1984
WHL	Wheel
WPT	Waypoint
WT	Weight
WXR	Weather Radar

X	
X–FEED	Crossfeed
XPDR or XPNDR	Transponder
XTK	Cross Track

Copyright © Delta Air Lines, Inc. See title page for details.

Revision Transmittal Letter

To: All holders of Delta Air Lines, Inc. 777 Aircraft Operations Manuals.

Subject: Flight Crew Operations Manual Revision.

This revision reflects the most current information available through the subject revision date. The following revision highlights explain changes in this revision. General information below explains the use of revision bars to identify new or revised information.

Revision Record

No.	Revision Date	Date Filed
00	October 14, 1998	
02	March 30, 1999	
04	December 15, 1999	
06	November, 30, 2001	
08	November 25, 2002	
10	December 15, 2003	
12	January 31, 2005	
14	March 31, 2006	
16	December 26, 2006	
18	February 15, 2008	

No.	Revision Date	Date Filed
01	March 19, 1999	
03	May 31, 1999	
05	November 17, 2000	
07	June 14, 2002	
09	April 15, 2004	
11	August 15, 2004	
13	September 6, 2005	
15	December 18, 2006	
17	December 20, 2007	

Complete Manual Reprint

This revision is a complete reprint. Please remove and replace all pages in this manual.

DO NOT DISCARD THE COVERS AND TABS FOR THIS MANUAL.

Due to a change in the company trademark, all pages in this revision have a new revision date applied, however, not all pages contain revised content. Please refer to the List of Effective Pages (PQ.5) for the specific location of revised content identified by a revision bar.

Copyright © Delta Air Lines, Inc. See title page for details.

General

Delta Air Lines, Inc. issues operations manual revisions to provide new or revised procedures and information. Revisions also incorporate appropriate information from previously issued Flight Crew Bulletins.

The revision date is the approximate date the manual is distributed. The revision should be incorporated on the revision date, but may be incorporated as much as 21 days after the revision date.

Formal revisions include a Revison Notification Transmittal Letter, a new Revision Record, Revision Highlights, and a current List of Effective Pages. Use the information on the new Revision Record and List of Effective Pages to verify the manual content.

The record above should be completed by the person incorporating the revision into the manual.

Filing Instructions

Consult the List of Effective Pages (P1.5). Pages identified with an asterisk (*) are either replacement pages, new (original) issue pages, or deleted pages. Remove pages marked DELETED; there are no replacement pages for deleted pages.

Be careful when inserting changes not to throw away pages from the manual that are not replaced. The List of Effective Pages determines the correct content of the manual.

Copyright © Delta Air Lines, Inc. See title page for details.

Revision Highlights

This section (P1.4) replaces the existing section P1.4 in your manual.

Pages containing revised technical and non-technical revisions have revision bars associated with the changed text or illustration.

Repaginated material not containing technical revisions is identified only by a new page date.

Chapter P1 - Preface

Section 1 - Model Identification

P1.1.1 - Revised airplane numbers to reflect actual company identification.

P1.1.1 - Added airplanes to model identification table to reflect operations with 777-232LR aircraft.

Section 2 - Introduction

P1.2.1 - Revised Captain's judgement sentence for clarity.

P1.2.2 - Updated instructions for submitting changes to the manual.

P1.2.2 - Reformatted Volume 1 organization information and added Preface chapter information for consistency with other Delta aircraft operations manuals.

P1.2.2 - Added differences chapter information due to operations with 777-232LR aircraft.

P1.2.3-4 - Added airplane effectivities identificaton information for operations with 777-232LR aircraft.

Section 3 - Abbreviations

P1.3-12 - Updated abbreviations table for consistency with other Delta aircraft operations manuals.

Section 4 - Revision Record

P1.4.1-14 - Revision record and highlights for current revision.

Section 5 - List of Effective Pages

P1.5.1-4 - Effective page information updated to reflect current revision.

Chapter L - Limitations

Section 0 - Table of Contents

L.TOC.0.1-2 - Updated table of contents to reflect changes in this chapter.

Copyright © Delta Air Lines, Inc. See title page for details.

Section 10 - Operating Limitations

Airplane General

L.10.1 - Added header information to general limits table.

L.10.1 - Added weather radar ground operation limit.

L.10.2 - Added weight limitations for 777-200LR airplanes.

L.10.2 - Added Flight Deck Access System check requirement.

Autopilot/Flight Director System

L.10.3 - Revised autopilot disengagement limit.

L.10.3 - Revised ILS approach limit.

Engine Limit Display Markings

L.10.4 - Deleted EGT chart.

Engine Fuel System

L.10.4 - Revised fuel temperature limit information to reflect new engine type.

Non-AFM Operational Information

L.10.5 - Added N1 limitation for taxiing airplanes with GE90 engines.

Chapter NP - Normal Procedures

Section 0 - Table of Contents

NP.TOC.0.1-2 - Updated table of contents to reflect changes in this chapter.

Section 10 - Introduction

General

NP.10.1 - Revised Normal Procedures chapter description.

Normal Procedures Philosophy

NP.10.1-2 - Revised Normal Procedures philosophy information to match Boeing's format.

Configuration Check

NP.10.2 - Reformatted configuration check philosophy to match Boeing.

Crew Duties

NP.10.3 - Reformatted the crew duties philosophy information to match Boeing.

Crew Duties Reference Chart

NP.10.4-7 - Reformated crew duties charts by phase of flight titles.

Copyright © Delta Air Lines, Inc. See title page for details.

NP.10.4 - Deleted sign in duty.

NP.10.4 - Deleted flight folder duty.

NP.10.4 - Added recency review duty.

NP.10.4 - Added flight folder creation duty.

NP.10.4 - Revised verify flight plan duty.

NP.10.4 - Deleted First Officer briefing duties.

NP.10.4 - Added oceanic plotting chart verification.

NP.10.5 - Moved logbook check.

NP.10.5 - Added altimeter RVSM check.

NP.10.5 - Deleted altimeter check, SELCAL check, FMC loading, FMC load verification, security briefing, and final documents duties.

NP.10.5 - Added min fuel for pushback item.

NP.10.6 - Added enroute fuel temperature monitoring item.

NP.10.6 - Added strategic lateral offset selection duty.

NP.10.7 - Added strategic lateral offset confirmation item.

NP.10.7 - Revised duty to check and review navigational information.

NP.10.7 - Deleted duplicate chart legend information.

Control Display Unit (CDU) Procedures

NP.10.8 - Relocated and reformatted CDU procedures to match latest Boeing information.

Autopilot Flight Director System (AFDS) Procedures

NP.10.8 - Relocated and reformatted the autopilot flight director system information.

RVSM Operations and System Requirements

NP.10.8 - Relocated and reformatted the RVSM operations information.

ILS Airborne Equipment Requirements

NP.10.9 - Reformatted table heading line for consistency.

NP.10.9 - Deleted the autopilot-flight director and engine inoperative notes, and added reference to the MDM.

RNAV Approach Equipment Requirements List

NP.10.10 - Added RNAV approach equipment information.

Standard Callouts

NP.10.11-15 - Reformated standard callouts tables by phase of flight titles.

Copyright © Delta Air Lines, Inc. See title page for details.

NP.10.13 - Deleted "bar."

NP.10.14 - Changed "At minimums" to "At DA."

NP.10.14 - Changed "At or before minimums" to "At or before DA."

NP.10.14 - Changed "above minimums" to "above AH."

NP.10.15 - Changed "F" to "PM."

NP.10.15 - Changed "ROLLOUT CAPTURED" to "ROLLOUT CAPTURE."

Preflight and Postflight Scan Flow

NP.10.16 - Added scan flow diagram introduction.

NP.10.17 - Revised scan flow diagram to reflect updated normal procedures flow.

Areas of Responsibility - Captain as Pilot Flying

NP.10.18 - Revised areas of responsibility chart to match Boeing's format.

Areas of Responsibility - First Officer as Pilot Flying

NP.10.19 - Revised areas of responsibility chart to match Boeing's format.

Section 20 - Amplified Procedures

Preliminary Preflight Procedure – Captain or First Officer

NP.20.1-3 - Created new Preliminary Preflight Procedures using initial Preflight Procedure items.

NP.20.2-3 - Added information to reflect addition of new aircraft type in fleet.

Exterior Inspection

NP.20.4 - Added general inspection items to match other fleets.

NP.20.5-9 - Revised exterior inspection route format to match Boeing information.

CDU Preflight Procedure - Pilot Flying

NP.20.11-13 - Created new procedure using CDU preflight items from the Preflight Procedure.

Preflight Procedure – First Officer

NP.20.14-23 - Revised and reorganized the Preflight Procedure to reflect only those items the Pilot Monitoring must accomplish.

NP.20.14 - Incorporated first flight of the day information.

NP.20.14-15 - Added information to reflect addition of new airplane type.

NP.20.15 - Added overhead panel ELT switch.

NP.20.20 - Added integrated standby instrument information.

Copyright © Delta Air Lines, Inc. See title page for details.

NP.20.22 - Added information to reflect addition of 777-232LR.

Preflight Procedure – Captain and First Officer

NP.20.24-26 - Added new procedure that includes all steps required for each crew member's area of responsibility.

NP.20.24 - Added step for installed EFB.

Before Start Procedure

NP.20.27 - Added instruction to ensure CDU preflight accomplished first.

NP.20.27-29 - Revised procedures to match Boeing format.

NP.20.29 - Added step for installed EFB.

Pushback/Start Procedure

NP.20.31 - Revised steps for clarity and to match Boeing format

NP.20.32 - Added information to reflect addition of 777-232LR.

NP.20.32 - Added system information to flight deck door item.

NP.20.32 - Revised recall information for clarity.

NP.20.32 - Added instructions to use AWABS data for stabilizer setting.

NP.20.33 - Revised transponder information to match other fleets.

NP.20.33 - Relocated beacon item.

NP.20.33 - Added caution information to match Boeing data.

NP.20.33 - Revised checklist instructions for clarity.

Engine Start Procedure

NP.20.34 - Revised engine start sequence information to reflect addition of 777-232LR.

NP.20.34 - Revised autostart information to match Boeing data.

NP.20.35 - Revised engine abort log instruction.

NP.20.35 - Added note regarding when not to make aborted engine start log entry.

After Start Procedure

NP.20.35 - Revised checklist instructions for clarity.

Taxi Procedure

NP.20.36 - Added instruction to verify ground equipment is clear.

NP.20.36 - Revised flight control check for clarity.

NP.20.36 - Revised checklist information for clarity.

NP.20.36 - Added extended ground time information.

Copyright © Delta Air Lines, Inc. See title page for details.

Before Takeoff Procedure

NP.20.37 - Revised engine warm-up requirements to reflect addition of 777-232LR.

NP.20.37 - Added flap indication verification.

NP.20.37 - Deleted flap setting information.

NP.20.37 - Added information under windows item.

NP.20.37 - Relocated takeoff briefing item above runway change item.

NP.20.38 - Relocated Flight Attendant briefing item to after runway change item.

NP.20.38 - Revised final items accomplishment information and added location confirmation instructions.

NP.20.39 - Revised exterior lights information.

NP.20.39 - Revised checklist instructions for clarity.

Takeoff Procedure

NP.20.40 - Reformatted procedure table to match new Boeing organization.

NP.20.41 - Combined takeoff and after takeoff procedures.

NP.20.41 - Deleted VNAV engagement verification.

NP.20.41 - Incorporated checklist instructions into table.

Climb and Cruise Procedure

NP.20.43 - Added guidance as to when to accomplish this procedure.

NP.20.43 - Changed order of altimeter setting and landing lights items.

NP.20.43 - Combined the climb and cruise procedures.

Descent Procedure

NP.20.44 - Revised descent procedure introduction.

NP.20.44 - Reformatted seatbelt item to match Boeing format.

NP.20.44 - Revised review and recall instructions for clarity.

NP.20.44 - Added reference to radio/baro minimums chart.

NP.20.44 - Changed "verify" to "set" in landing lights item.

NP.20.44 - Added VREF verification steps.

NP.20.44 - Added approach briefing instruction.

NP.20.44 - Incorporated checklist instructions into table.

RADIO/BARO Minimums Chart

NP.20.45 - Relocated chart.

Copyright © Delta Air Lines, Inc. See title page for details.

NP.20.45 - Changed straight-in approcach minimum to DA or DDA.

Approach Procedure

NP.20.46 - Added procedure introduction

NP.20.46 - Added instruction to update changes to arrival and to the RNP.

NP.20.46 - Added instruction to notify crew to prepare for landing.

NP.20.46 - Revised no smoking selector instruction for clarity.

NP.20.46 - Added instruction to update approach briefing.

NPl20.46 - Incorporated checklist instructions into table.

Flap Extention Schedule

NP.20.46 - Added schedule to reflect Boeing information.

Landing Procedure - ILS

NP.20.47 - Revised procedure title to reflect addition of a new follow on landing procedure.

NP.20.47 - Revised procedure table to match new Boeing organization.

NP.20.47 - Added APP mode arming step.

NP.20.47 - Added final approach course intercept instruction.

NP.20.47 - Incorporated checklist instructions into table.

Landing Procedure - Instrument Approach Using VNAV

NP.20.48-49 - Added new Boeing landing procedure.

Go-Around and Missed Approach Procedure

NP.20.50 - Revised table to match new Boeing organization.

NP.20.50 - Added climb thrust verification step.

NP.20.50 - Incorporated checklist instructions into table.

Landing Roll Procedure

NP.20.51 - Reformatted table to match new Boeing organization.

NP.20.51 - Relocated reverse thrust warning in table.

NP.20.51 - Added Caution about not using Airport Map application to accommodate airplanes equipped with EFB.

After Landing Procedure

NP.20.52 - Revised procedure accomplishment instruction.

NP.20.52 - Revised engine cooldown instructions to reflect addition of 777-232LR airplanes.

Copyright © Delta Air Lines, Inc. See title page for details.

NP.20.52 - Reformatted after landing procedure items into table arrangement to match new Boeing format.

Shutdown Procedure

NP.20.53 - Added introduction sentence.

NP.20.53 - Reformatted entire procedure to match Boeing format for this information.

NP.20.53 - Added information to reflect addition of 777-232LR airplanes.

NP.20.54 - Added step for installed EFB.

NP.20.55 - Change circuit breaker item response to "As required".

Secure Procedure

NP.20.56 - Added step for installed EFB.

NP.20.56 - Revised checklist instructions for clarity.

Section 30 - Flight Patterns

Takeoff Considerations

NP.30.1 - Added "LNAV" title.

ILS Approach Considerations

NP.30.4 - Relocated ILS approach reference information.

Visual Approach and Landing Considerations

NP.30.4 - Relocated visual approach information after ILS PRM infomation.

Normal Takeoff (Distant/ICAO NADP2)

NP.30.5 - Corrected ICAO identification for this profile.

NP.30.5 - Revised profile to reflect new climb restriction information.

Special Takeoff (Close-In/ICAO NADP1)

NP.30.6 - Corrected ICAO identification for this profile.

ILS Approach

NP.30.7 - Revised profile title to match Boeing format.

Instrument Approach Using VNAV

NP.30.8 - Revised profile title to match Boeing format.

Instrument Approach Using V/S or FPA

NP.30.9 - Revised profile title to match Boeing format.

NP.30.9 - Changed Inbound location from "approximately 2NM" to "prior to FAF."

Copyright © Delta Air Lines, Inc. See title page for details.

Circling Approach

NP.30.10 - Revised profile title to match Boeing format.

Visual Traffic Pattern

NP.30.11 - Revised profile title to match Boeing format.

Go-Around and Missed Approach

NP.30.7 - Revised profile title to match Boeing format.

Chapter SP - Supplementary Procedures

Section 0 - Table of Contents

SP.TOC.0.1-2 - Updated table of contents to reflect changes in this chapter.

Section 05 - Introduction

General

SP.05.1 - Added exception for Adverse Weather section.

Section 1 - Airplane General, Emer. Equip., Doors, Windows

Cabin Inspection

SP.1.1 - Change Flights Without Flight Attendants into Cabin Inspection to match other fleets identification for this procedure and revised for clarity.

Flight Deck Door Access System Test

SP.1.2 - Procedure for testing Flight Deck Security Door on 777-232LR airplanes added.

SP.1.3-4 - Procedure for testing Flight Deck Security Door on 777-232ER airplanes revised.

Oxygen Mask Test

SP.1.5 - Revised procedure for clarity.

Upper Crew Rest Compartments - Ships 7101 & Subsequent

SP.1.6 - Added new procedure for 777-232LR airplanes.

Upper Crew Rest Compartments - Ships 7001 - 7008

SP.1.7 - Revised procedure for clarity.

Section 2 - Air Systems

Packs Off Takeoff

SP.2.1 - Added information to reflect new engine type.

APU to Pack Takeoff

SP.2.2 - Added to reflect installed option for 777-232LR airplanes.

Copyright © Delta Air Lines, Inc. See title page for details.

Section 4 - Automatic Flight

Non-ILS Instrument Approach

SP.4.5 - Revised entire procedure for clarity and included RNAV approach instructions.

Circling Approach

SP.4.11 - Added MDA to MCP altitude selector step.

PAR Approach

SP.4.11 - Revised roll and pitch mode information for clarity.

SP.4.12 - Added instruction to disengage autopilot no lower than 200 feet AGL.

Section 5 - Communications

Takeoff Data

SP.5.1 - Deleted cabin interphone and PA inoperative procedures due to their incorporation in the Quick Reference Handbook.

AWABS Update Request

SP.5.2 - Corrected procedure formatting.

Cabin Medical Communication

SP.5.6 - Added procedure to configure 777LR cabin medical communication system.

Cockpit Voice Recorder Test

SP.5.7 - Relocated procedure to match organization in other fleets and added information reflecting addition of 777-232LR airplanes.

CPDLC/ADS Procedures

SP.5.8-12 - Updated entire CPDLC/ADS procedure.

Delay Codes

SP.5.13 - Revised code entry instructions for clarity.

SP.5.16-17 - Added FIRM code downlink instructions.

Section 7 - Engines, APU

Engine Battery Start

SP.7.1 - Revised preflight procedure reference to match new procedure title.

Engine Crossbleed Start

SP.7.1 - Added information to reflect 777-232LR airplane operations.

Copyright © Delta Air Lines, Inc. See title page for details.

Manual Engine Start - GE-90

SP.7.3 - Added manual start procedure for new engine type.

Manual Engine Start RR-895

SP.7.4 - Added effectivity information.

SP.7.4 - Revised autostart information for clarity.

Manual Overide Engine Start

SP.7.5 - Added information reflecting addition of new engine type.

Section 8 - Fire Protection

Fire Warning System Test

SP.8.1 - Revised procedure to match Boeing information.

Section 11 - Flight Management, Navigation

Double Derate Takeoff Procedure

SP.11.2 - Added procedure for double derate capability in 777LR aircraft.

Navigation Accuracy Check

SP.11.5 - Changed FMC Class II Navigation title to "Navigation Accuracy Check" to match other fleets.

SP.11.5 - Revised procedure for clarity.

FMS Waypoint Loading Procedure

SP.11.6 - Added procedure from FCB 04-05 "New FMS Waypoint Loading Procedures."

Runway Change Procedure

SP.11.8-9 - Revised procedure for clarity.

Takeoff Bump Thrust Procedure

SP.11.10 - Added procedure for thrust bump capability in 777LR aircraft.

Section 16 - Adverse Weather

Takeoff Procedure

SP.16.6 - Added information reflecting addition of new airplane type.

Engine Anti-Ice Operation - In-flight

SP.16.7-8 - Added information reflecting addition of new airplane type.

Engine Anti-ice Operation - In-flight

SP.16.8 - Changed TAT to SAT.

Climb, Cruise, and Descent Considerations

SP.16.42-43 - Added extreme turbulence procedure for GE engines.

Copyright © Delta Air Lines, Inc. See title page for details.

Chapter DF - Differences

Section 0 - Table of Contents

DF.TOC.0.1-2 - Added table of contents for new chapter.

Section 10 - 777 Differences

DF.10.1-4 - Added differences information for 777-232ER/LR airplanes.

Copyright © Delta Air Lines, Inc. See title page for details.

Page	Date
Volume 1	
* Title Page	February 15, 2008
Preface	
P1.0.1-2	February 15, 2008
* P1.1.1	February 15, 2008
* P1.2.1-4	February 15, 2008
P1.3.1-12	February 15, 2008
* P1.4.1-14	February 15, 2008
* P1.5.1-2	February 15, 2008
Bulletin Record (tab)	
P1.6.1-2	See Bulletin Record
Limitations (tab)	
* L.TOC.0.1-2	February 15, 2008
* L.10.1-5	February 15, 2008
L.10.6	February 15, 2008
Normal procedures (tab)	
* NP.TOC.0.1-4	February 15, 2008
* NP.10.1-20	February 15, 2008
* NP.20.1-9	February 15, 2008
NP.20.10	February 15, 2008
* NP.20.11-29	February 15, 2008
NP.20.30	February 15, 2008
* NP.20.31-41	February 15, 2008
NP.20.42	February 15, 2008
* NP.20.43-56	February 15, 2008
* NP.30.1	February 15, 2008
NP.30.2-3	February 15, 2008
* NP.30.4-12	February 15, 2008

Page	Date
Supplementary Procedures (tab)	
* SP.TOC.0.1-6	February 15, 2008
* SP.05.1	February 15, 2008
SP.05.2	February 15, 2008
* SP.1.1-8	February 15, 2008
* SP.2.1-2	February 15, 2008
SP.3.1-2	December 20, 2007
SP.4.1-4	February 15, 2008
SP.4.5-12	February 15, 2008
* SP.5.1-13	February 15, 2008
SP.5.14-15	February 15, 2008
* SP.5.16-18	February 15, 2008
SP.6.1-2	February 15, 2008
* SP.7.1-5	February 15, 2008
SP.7.6	February 15, 2008
* SP.8.1	February 15, 2008
SP.8.2	February 15, 2008
SP.10.1-2	February 15, 2008
SP.11.1	February 15, 2008
* SP.11.2	February 15, 2008
SP.11.3-4	February 15, 2008
* SP.11.5-6	February 15, 2008
SP.11.7	February 15, 2008
* SP.11.8-10	February 15, 2008
SP.12.1-2	February 15, 2008
SP.16.1-5	December 20, 2007

* = Revised, Added, or Deleted

Copyright © Delta Air Lines, Inc. See title page for details.

Page	Date
Supplementary Procedures (cont.)	
* SP.16.6-8	February 15, 2008
SP.16.9-41	December 20, 2007
* SP.16.42-43	February 15, 2008
SP.16.44-48	December 20, 2007
Differences (tab)	
* DF.TOC.0.1-2	February 15, 2008
* DF.10.1-4	February 15, 2008

* = Revised, Added, or Deleted

Copyright © Delta Air Lines, Inc. See title page for details.

Limitations — Chapter L
Table of Contents — Section 0

Copyright © Delta Air Lines, Inc. See title page for details.

Copyright © Delta Air Lines, Inc. See title page for details.

General

This chapter contains Airplane Flight Manual (AFM) limitations and Boeing recommended non-AFM operating limitations. Limitations that are obvious, shown on displays or placards, or incorporated within an operating procedure are not contained in this chapter.

B-777 aircraft must be operated in compliance with Certificate Limitations of the applicable FAA Approved Airplane Flight Manual and the Minimum Equipment List contained in the Mechanical Dispatch Manual (MDM).

Note: The symbol (#) indicates recall limitations. Recall limitations are those operationally significant limitations that must be committed to memory. Memorization is necessary because there are no placards, display indications, or markings indicating a limitation exists.

Airplane General

Operational Limits	
# Runway slope	+/- 2%
# Maximum Operating Altitude	43,100 feet pressure altitude
# Maximum Takeoff and Landing Altitude	8,400 feet pressure altitude
# Maximum Takeoff and Landing Tailwind Component	10 knots, or as permitted by Delta 10-0 special pages.

Non–AFM Operational Information

The turbulent air penetration speed (in severe turbulence) is defined as:

- 270 KIAS below 25,000 feet
- 280 KIAS/.82 Mach (whichever is lower) at and above 25,000 feet. Maintain a minimum speed of 15 knots above the minimum maneuvering speed (amber band) when below 0.82 Mach.

The maximum demonstrated takeoff and landing crosswind is 38 knots.

Do not operate HF radios during refueling operations.

Do not operate the weather radar in a hangar or within 50 feet (15.25 meters) of any personnel or a fuel spill.

Note: The hangar and personnel restrictions do not apply to the weather radar test mode.

Copyright © Delta Air Lines, Inc. See title page for details.

RVSM Operations

Non-AFM Operational Information

Prior to takeoff the maximum allowable difference between Captain's or First Officer's altitude display and field elevation is 75 feet.

The standby altimeter does not meet altimeter accuracy requirements of RVSM airspace.

Weight Limitations

Ships 7101 & Subsequent

Weights	Pounds
Maximum Taxi Weight	768,000
Maximum Takeoff Weight	766,000
Maximum Landing Weight	492,000
Maximum Zero Fuel Weight	461,000

Ships 7001 – 7008

Weights	Pounds
Maximum Taxi Weight	657,000
Maximum Takeoff Weight	656,000
Maximum Landing Weight	460,000
Maximum Zero Fuel Weight	430,000

Door Mounted Power Assists and Escape Slides

Main door emergency power assists and evacuation slide systems must be armed with the mode select handle in the ARMED position prior to taxi, takeoff and landing whenever passengers are carried.

Flight Deck Security Door

Verify that an operational check of the Flight Deck Access System has been accomplished according to approved procedures once each flight day.

Copyright © Delta Air Lines, Inc. See title page for details.

Air Systems

Cabin Pressurization

Maximum differential pressure (relief valves)	9.1 psi
Maximum allowable cabin pressure differential for takeoff and landing	0.11 psi

Autoflight

Autopilot/Flight Director System

The autopilot must not be engaged below a minimum engage altitude of 200 feet AGL after takeoff.

The autopilot must be disengaged before the airplane descends more than 50 feet below the DA/DDA unless it is coupled to an ILS glideslope and localizer or in the go–around mode.

When flying an ILS appproach without LAND 2 or LAND 3 annunciated, the autopilot must be disengaged before the airplane decends below 200 feet AGL.

Automatic Landing

When landing weather minima are predicated on autoland operations the following limits apply:

Maximum Allowable Wind Speeds	
Headwind	25 knots
Tailwind	10 knots
Crosswind	25 knots

The maximum glideslope angle is 3.25 degrees.

The minimum glideslope angle is 2.5 degrees.

Automatic landings can be made using flaps 20 or 30, with both engines operative or one engine inoperative. The autopilot flight director system (AFDS) autoland status annunciation must display LAND 2 or LAND 3.

Copyright © Delta Air Lines, Inc. See title page for details.

Communications

Flight Deck Communications Systems (Datalink)

The datalink from the COMPANY format is limited to the transmission and receipt of messages, which will not create an unsafe condition if the message is improperly received, such as the following conditions:

- the message or parts of the message are delayed or not received,
- the message is delivered to the wrong recipient, or
- the message content may be frequently corrupted.

However, Pre-Departure Clearance, Digital Automatic Terminal Information Service, Oceanic Clearances, Weight & Balance, and Takeoff Data messages can be transmitted and received via the COMPANY format if they are verified per approved operational procedures.

HF Communication System

If one HF radio is selected for transmission, deselect the other HF radio on all audio control panels to prevent audio interference.

Engines

Engine Limit Display Markings

Maximum and minimum limits are red.

Caution limits are amber.

Engine Oil System

Oil temperature must be greater than -40 degrees C for engine start and 50 degrees C before advancing thrust levers to takeoff power.

Engine Fuel System

The use of JP–4 and Jet B fuels is prohibited.

The maximum tank fuel temperature is 49 degrees C.

Tank fuel temperature prior to takeoff must not be less than (GE90) -40 degrees C, (RR 895) -37 degrees C, or 3 degrees above the fuel freezing point, whichever is higher. In-flight tank fuel temperature must be maintained at least 3 degrees C above the freezing point of the fuel being used. The use of Fuel System Icing Inhibitor additives does not change the minimum fuel tank temperature limit.

Copyright © Delta Air Lines, Inc. See title page for details.

Reverse Thrust

Intentional selection of reverse thrust in flight is prohibited.

Backing the airplane with use of reverse thrust is prohibited.

Non-AFM Operational Information

Ships 7101 & Subsequent
For ground operation (exclusive of takeoff) in tailwinds and crosswinds between 30 and 45 knots, engine power should be limited to a maximum of 70% N1. Avoid thrust levels above that required for normal taxi operation in all tailwinds and crosswinds greater than 45 knots.

Airplane Structure

Flight Controls

Avoid rapid and large alternating control inputs, especially in combination with large changes in pitch, roll, or yaw (e.g. large side slip angles) as they may result in structural failure at any speed, including below V_A (design maneuvering speed).

Non-AFM Operational Information

Ground wind limits for all doors:

- 40 knots while opening or closing
- 65 knots while open.

Flight Management, Navigation

ADIRU

ADIRU alignment must not be attempted at latitudes greater than 78 degrees, 14.75 minutes.

QFE Selection

A QFE altitude reference for the primary flight displays must be selected in the flight management system whenever QFE is used instead of QNH.

Copyright © Delta Air Lines, Inc. See title page for details.

Fuel System

Main tanks must be scheduled to be full if center tank fuel is loaded.

Note: The center tank may contain up to 3000 pounds of fuel with less than full main tanks provided center tank fuel weight plus actual zero fuel weight does not exceed the maximum zero fuel weight, and center of gravity limits are observed.

Warning Systems

GPWS - Look-Ahead Terrain Alerting

Do not use the terrain display for navigation.

The use of look-ahead terrain alerting and terrain display functions is prohibited within 15 NM of takeoff, approach or landing at an airport or runway not contained in the GPWS terrain database. For airports and runways contained in the installed GPWS terrain database, crews will be notified via EFCB and flight plan remarks.

TCAS

Pilots are authorized to deviate from their current ATC clearance to the extent necessary to comply with a TCAS II resolution advisory.

Copyright © Delta Air Lines, Inc. See title page for details.

Normal Procedures — Chapter NP
Table of Contents — Section 0

Copyright © Delta Air Lines, Inc. See title page for details.

Copyright © Delta Air Lines, Inc. See title page for details.

Copyright © Delta Air Lines, Inc. See title page for details.

Intentionally
Blank

Copyright © Delta Air Lines, Inc. See title page for details.

General

This chapter provides:

- an introduction to the normal procedures philosophy and assumptions
- step by step normal procedures

Controls and Indicators – Nomenclature

Controls and indications appear in all UPPERCASE type to correspond to the words on the control panel or display. For example, the following item has UPPERCASE words to match what is found on the panel:

PRIMARY FLIGHT COMPUTERS
DISCONNECT switch ..... AUTO (guarded position)

The word DISCONNECT is spelled out, even though it is abbreviated on the panel.

The following appears in all lower case because there are no words identifying the panel name:

Landing gear panel ..... Set

Normal Procedures Philosophy and Assumptions

Normal procedures verify for each phase of flight that:

- the airplane condition is satisfactory
- the flight deck configuration is correct

Normal procedures are done on each flight. Refer to the Supplementary Procedures (SP) chapter for procedures that are done as required, for example the adverse weather procedures.

Normal procedures are used by a trained flight crew and assume:

- all systems operate normally
- the full use of all automated features (LNAV, VNAV, autoland, autopilot, and autothrottle)

Continued on next page

Copyright © Delta Air Lines, Inc. See title page for details.

Continued from previous page

Normal procedures also assume coordination with the ground crew before:

- hydraulic system pressurization, or
- flight control surface movement, or
- airplane movement

Normal procedures do not include steps for flight deck lighting and crew comfort items.

Normal procedures are done by recall and scan flow. The panel illustration in this section shows the scan flow. The scan flow sequence may be changed as required.

Configuration Check

It is the crew member's responsibility to verify correct system response. Before engine start, use lights or indications to verify each system's condition or configuration.

If there is an incorrect configuration or response:

- verify that the system controls are set correctly
- check the respective circuit breaker as required. Maintenance must first determine that it is safe to reset a tripped circuit breaker on the ground.
- test the respective system light as required

Before engine start, review the EICAS alert messages and status display. If there are unexpected messages:

- check the Mechanical Dispatch Manual (MDM) to decide if the condition has a dispatch effect
- decide if maintenance is needed

If, during or after engine start, there is an alert message:

- do the respective non-normal checklist (NNC)
- on the ground, check the MDM

After engine start, EICAS alert messages are the primary means of alerting the flight crew to non-normal conditions or incorrect configurations.

After engine start, there is no need to check status messages. Any message that has an adverse affect on safe continuation of the flight appears as an EICAS alert message.

Note: The EICAS advisory message TCAS OFF is displayed until TA/RA is selected just prior to takeoff.

Copyright © Delta Air Lines, Inc. See title page for details.

Crew Duties

Preflight and postflight crew duties are divided between the Pilot Flying, Pilot Monitoring, Captain, and First Officer. Phase of flight duties are divided between the Pilot Flying (PF) and the Pilot Monitoring (PM).

Each crewmember is responsible for moving the controls and switches in their area of responsibility. The Area of Responsibility illustrations in this section show the area of responsibility for both normal and non-normal procedures. Typical panel locations are shown.

The Captain may direct actions outside of the crewmember's area of responsibility.

The general PF phase of flight responsibilities are:

- taxiing
- flight path and airspeed control
- airplane configuration
- navigation

The general PM phase of flight responsibilities are:

- checklist reading
- communications
- tasks asked for by the PF
- monitoring taxiing, flight path, airspeed, airplane configuration, and navigation

PF and PM duties may change during a flight. For example, the Captain could be the PF during taxi but be the PM during takeoff through landing.

Normal procedures may show who does a step by crew position (C, F/O, PF, or PM):

- in the procedure title, or
- in the far right column, or
- in the column heading of a table

The mode control panel is the PF's responsibility. When flying manually, the PF directs the PM to make the changes on the mode control panel.

The Captain is the final authority for all tasks directed and done.

Copyright © Delta Air Lines, Inc. See title page for details.

Crew Duties Reference Chart

The Crew Duties Reference Chart below indicates normal divisions in pilot work load. This chart serves as a guide to help crew members coordinate their duties with regard to a typical flight.

- items not highlighted are required on every flight
- items highlighted with gray shading are required during class II navigation only.

The chart delineates areas in which a crew member must remain reasonably proficient if crew coordination is to be maintained at an optimum level.

When operating with an additional First Officer, the Captain will designate one of the First Officers to perform relief pilot (RP) duties.

When operating without an additional First Officer, the F or PM will perform the duties listed for the RP. These are indicated by a bullet in parentheses (•). Special situations or unusual occurrences may require some deviations from the charted duties; the Captain ultimately makes that determination.

FLIGHT PLANNING					
Crew Duties	**C**	**F**	**RP**	**PF**	**PM**
Confirm license, medical, ID, passport, and visas are in possession and current.	•				
Review recency, brief relief Captain and F/O, and assign duties.	•				
Create flight folder contents (flight plan, track message, weather, turbulence, charts, etc).	•				
Review flight plan; routing, remarks, and alternates				•	•
Verify Flight Plan - check routing & dates match on: NARs, NAT message, and NOPACs	•	•			
Review and brief weather information - (departure, destination, enroute, and alternate) and NOTAMs.		(•)	•		
Prepare oceanic plotting chart. (if required)				•	
Verify oceanic plotting chart (PM reads waypoints from chart to PF to check).				•	•
Ensure flight folder delivered to aircraft.				•	

Continued on next page

Copyright © Delta Air Lines, Inc. See title page for details.

Continued from previous page

FLIGHT DECK PREPARATION					
Crew Duties	**C**	**F**	**RP**	**PF**	**PM**
Check aircraft log book.	•	(•)	•		
Complete exterior and interior preflight - confirm water and lavatories serviced and Door 1 Upper Crew Rest Compartment preflighted.		(•)	•		
Verify clocks set to UTC.				•	•
Altimeter RVSM check.	•	•			
Check ADIRU on and update present position.				•	
Verify correct alignment coordinates - use independent sources.			•		•
Log coordinates on Flight Plan.					•
Enter date on ACARS initialization page (Sending not required).					•
Initialize ADS/CPDLC.					•
Reset checklists					•
Perform HF checks. Caution: Do not transmit on HF while fueling.		(•)	•		
Ensure min fuel for pushback.	•	(•)	•		

TAXI AND BEFORE TAKEOFF					
Crew Duties	**C**	**F**	**RP**	**PF**	**PM**
Review transition altitude.			•	•	•
Check aircraft position relative to takeoff runway on ND - 10 MILE scale.			•	•	•
Ensure MIN FUEL FOR T/O.	•	(•)	•		

Continued on next page

Copyright © Delta Air Lines, Inc. See title page for details.

Continued from previous page

ABOVE 10,000 FEET					
Crew Duties	**C**	**F**	**RP**	**PF**	**PM**
Compute ETAs on Flight Plan.			•		(•)
Maintain Howgozit Log - "R" Points					•
At TOC - RVSM check.					•
Monitor enroute fuel temperatures.			•	•	•

PRIOR TO TRACK ENTRY					
Crew Duties	**C**	**F**	**RP**	**PF**	**PM**
Obtain oceanic clearance.			•		(•)
Complete ADS/CPDLC Logon - send 15 - 45 min. prior to track					•
Update ETP alternate weather- hourly and forecast.					•
Perform Navigation Accuracy Check- annotate on flight. plan.					•

TRACK ENTRY					
Crew Duties	**C**	**F**	**RP**	**PF**	**PM**
Perform HF SELCAL check.					•
Set cruise Mach.				•	
Check autoflight system- bank angle AUTO.				•	
Set VHF radios: left- 121.5, right- 123.45.					•
Set transponder code- squawk 2000 after 30 min. on NAT or when directed by ATC.					•
Select strategic lateral offset (0, 1, 2 nm right).				•	•

Copyright © Delta Air Lines, Inc. See title page for details.

WAYPOINT PASSAGE					
Crew Duties	**C**	**F**	**RP**	**PF**	**PM**
Read and confirm next waypoint, desired track, distance, zone time.				•	•
Confirm aircraft established on desired track after passing waypoint, check LNAV engaged				•	•
Record AIREP data, and make HF position report - include wx (if required)					•
Send ACARS position report.				•	
Record post position plot on plotting chart.				•	

TRACK EXIT					
Crew Duties	**C**	**F**	**RP**	**PF**	**PM**
Confirm ATC clearance (if required).				•	•
Request altitude and desired cruise Mach speed from ATC.				•	•
Confirm strategic lateral offset is zero.				•	•

TOP OF DESCENT					
Crew Duties	**C**	**F**	**RP**	**PF**	**PM**
Perform APU start (if requested).			•		(•)
Check transition altitude, review Airway Manual, NOTAMs, ATC Route Information, Arrivals, STARS, Approaches, Emergency and 10-0 pages.			•	•	•
Send ACARS/In-Range report.					•

SHUTDOWN / POSTFLIGHT					
Crew Duties	**C**	**F**	**RP**	**PF**	**PM**
Complete FLIGHT SUMMARY.		•			
Complete ACARS postflight- print flight log (if required).		•			
Confirm flight folder contents.		(•)	•		

Copyright © Delta Air Lines, Inc. See title page for details.

Control Display Unit (CDU) Procedures

Before taxi, the Captain or First Officer may make CDU entries. The other pilot must verify the entries.

Make CDU entries before taxi or when stopped, when possible. If CDU entries must be made during taxi, the First Officer makes the entries. The Captain must verify the entries before they are executed.

In flight, with the autopilot engaged, normally CDU entries are made by the PF and verified by the PM. With the autopilot not engaged, CDU entries are made by the PM with concurance from the PF. CDU manipulations should be accomplished prior to high workload periods such as departure, arrival, or holding.

During high workload times, try to reduce the need for CDU entries. Do this by using the MCP heading, altitude, and speed control modes. The MCP can be easier to use than entering complex route modifications into the CDU.

Autopilot Flight Director System (AFDS) Procedures

The crew must always monitor:

- airplane course
- vertical path
- speed

When selecting a value on the MCP, verify that the respective value changes on the flight instruments, as applicable.

The crew must verify manually selected or automatic AFDS changes. Use the FMA to verify mode changes for the:

- autopilot
- flight director
- autothrottle

During LNAV and VNAV operations, verify all changes to the airplane's:

- course
- vertical path
- thrust
- speed

Announcing changes on the FMA and thrust mode display when they occur is a good CRM practice.

RVSM Operations and System Requirements

Refer to the Airway Manual, Chapter 7, Navigation, Reduced Vertical Separation Minimum (RVSM) section.

Copyright © Delta Air Lines, Inc. See title page for details.

ILS Airborne Equipment Requirements

Equipment Not AFDS Monitored

System	CAT I	CAT II	CAT III
Anti-skid	0	0	Required
Autobrakes or Groundspeed Indication	0	0	Required
NDs	0	2	2
Normal Flight Controls	0	Required	Required
Windsheild Wipers (High)	0	2	2

Note: Additional low weather approach equipment requirements may be found under the navigation equipment tab in the MDM.

Copyright © Delta Air Lines, Inc. See title page for details.

RNAV Approach Equipment Requirements List

This list contains the equipment required to conduct an RNAV approach.

RNAV Equipment Requiremants		
Equipment Required	**RNAV Approach**	
	RNAV (GPS)	**RNAV (RNP)**
	Number Required	
ADIRU	1	1
AFDS FMA	1	2
Global Positioning System (GPS)	1	2
Autopilot	0	2
Autothrottle	0	1
Control Display Unit	1	2
EGPWS	0	1
EGPWS (Terrain Display Function)	0	1
Flight Director	1	2
FMC with current navigation database	1	2
EICAS	1	1
ND	1	2
PFD	1	2
Radio Altimeter	1	2
TO/GA switches	0	1

An RNAV approach may not be conducted with any of the following Single Source EICAS messages displayed:

- SGL SOURCE AIR DATA
- SGL SOURCE DISPLAYS
- SGL SOURCE RAD ALT
- SGL SOURCE F/D

An RNAV approach may not be conducted with any of the following NAV EICAS messages displayed:

- NAV ADIRU INERTIAL
- NAV AIR DATA SYS
- NAV UNABLE RNP

Copyright © Delta Air Lines, Inc. See title page for details.

Standard Callouts

Should the automated callouts fail, the “1000”, “500”, “Approaching Minimums”, and “Minimums” callouts must be verbalized by the PM

On any approach, when the Pilot Flying can maintain visual contact with the runway, the “APPROACHING MINIMUMS” and “MINIMUMS” callouts are optional.

Note: If the Radio Altimeter is inoperative, the “1000” and “500” AGL callouts must be determined by reference to the barometric altimeter.

TAKEOFF		
Condition	**Crew Member**	**Callout**
• At 80 KIAS when HOLD annunciated, if autothrottles used • If autothrottles not used, HOLD will not be annunciated	PM	“80 KNOTS, HOLD AND ENGINE INSTRUMENTS CHECKED” When PM announces “80 KNOTS”, the PF should silently verify that his airspeed indicator is operating properly
• At V1, VR and V2	PM	Confirm automatic V1 callout or call “V1”- THEN CALL - “VR”- “V2”
• At positive rate of climb	PM	“POSITIVE RATE”

CLIMB		
Condition	**Crew Member**	**Callout**
• 1,000 feet below each assigned altitude	PM	“OUT OF ___ FOR ___”
• Approaching transition altitude	PM	“ALTIMETERS SET TO STANDARD"

Copyright © Delta Air Lines, Inc. See title page for details.

DESCENT		
Condition	**Crew Member**	**Callout**
• 1,000 feet above each assigned altitude	PM	"OUT OF ___ FOR ___"
• Approaching transition level	PM	"ALTIMETERS SET TO ___"

APPROACH AND LANDING		
Condition	**Crew Member**	**Callout**
• Any significant deviation from planned flight path, airspeed or descent rate	PM	"BUG ± ___KNOTS" or "SINK ____", etc.
• At approximately 1,000 feet AGL	PM	"1,000, CLEARED TO LAND" or "1,000, NO LANDING CLEARANCE"
• At approximately 500 feet AGL	PM	"500"
• Below 500 feet AGL: • Any descent exceeding 1,000 feet per minute	PM	"SINK ___"

ALL INSTRUMENT APPROACHES		
Condition	**Crew Member**	**Callout**
• PM will call out flight mode annunciator progression	PM	"LOCALIZER CAPTURE" "GLIDE SLOPE ARMED", etc.

Copyright © Delta Air Lines, Inc. See title page for details.

NON-ILS APPROACHES		
Condition	**Crew Member**	**Callout**
• Within 5° of final approach course	PM	"APPROACHING INBOUND COURSE"
• At approximately 1,000 feet AGL	PM	"1,000, CLEARED TO LAND" or "1,000, NO LANDING CLEARANCE"
• At approximately 500 feet AGL	PM	"500"
• At approximately 80 feet above minimums	PM	"APPROACHING MINIMUMS"
• At MDA	PM	"MINIMUMS"
• When runway in sight	PM	"RUNWAY IN SIGHT"
• Prior to leaving MDA	CAPT	"APPROACH LIGHTS IN SIGHT", or "RUNWAY IN SIGHT" or "MISSED APPROACH" • F/O must acknowledge

ALL ILS APPROACHES		
Condition	**Crew Member**	**Callout**
• First positive movement of localizer	PM	"LOCALIZER ALIVE"
• First positive movement of glide slope	PM	"GLIDE SLOPE ALIVE"
• At approximately 1,000 feet AGL	PM	"1,000, CLEARED TO LAND" or "1,000, NO LANDING CLEARANCE"
• At approximately 500 feet AGL	PM	"500"

Copyright © Delta Air Lines, Inc. See title page for details.

CAT I & II APPROACHES		
Condition	**Crew Member**	**Callout**
• At approximately 80 feet above minimums	PM	"APPROACHING MINIMUMS"
• At DA	PM	"MINIMUMS"
• At or before DA	CAPT	"APPROACH LIGHTS IN SIGHT", or "RUNWAY IN SIGHT" or "MISSED APPROACH" • F/O must acknowledge

CAT III APPROACHES		
Condition	**Crew Member**	**Callout**
• At approximately 80 feet above AH	F	"APPROACHING MINIMUMS"
At AH	F	"MINIMUMS"
	CAPT	"LAND 3" or "MISSED APPROACH"

ALL AUTOLAND APPROACHES		
Condition	**Crew Member**	**Callout**
• When annunciated (approximately 1,500 feet RA)	PM	"ROLLOUT AND FLARE ARMED" "LAND 2" or "LAND 3"
• At approximately 1,000 feet AGL	PM	"1,000, CLEARED TO LAND" or "1,000, NO LANDING CLEARANCE"
• At approximately 500 feet AGL	PM	"500"

Copyright © Delta Air Lines, Inc. See title page for details.

ALL AUTOLAND APPROACHES		
Condition	**Crew Member**	**Callout**
• When annunciated (approximately 50 feet RA)	PM	"FLARE CAPTURE"
• When annunciated (approximately 2 feet RA)	PM	"ROLLOUT CAPTURE"
• If off centerline during rollout	PM	"STEER RIGHT" or "STEER LEFT" (As appropriate)

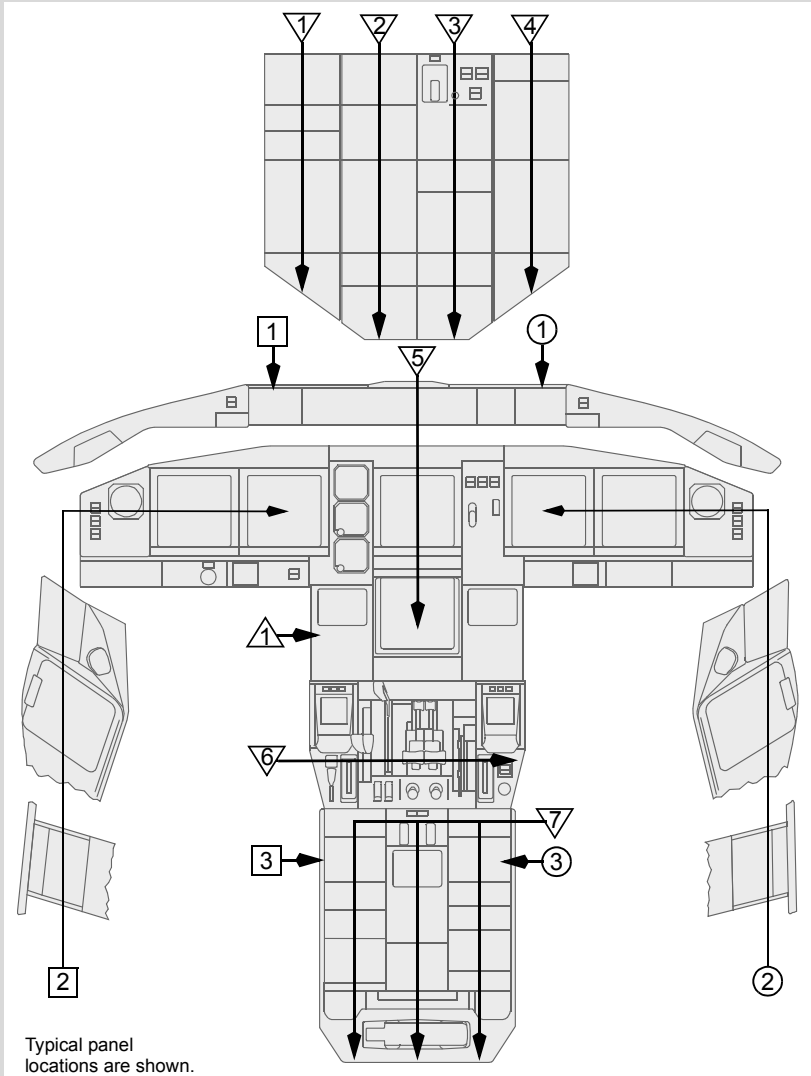
AFTER ALL LANDINGS		
Condition	**Crew Member**	**Callout**
• Verify thrust levers closed and speedbrake lever up)	PM	"SPEEDBRAKES UP"
• If speedbrake lever not up	PM	"SPEEDBRAKES NOT UP"
• At 60 knots, decrease to idle reverse by taxi speed	PM	"60 KNOTS"

Copyright © Delta Air Lines, Inc. See title page for details.

Preflight and Postflight Scan Flow

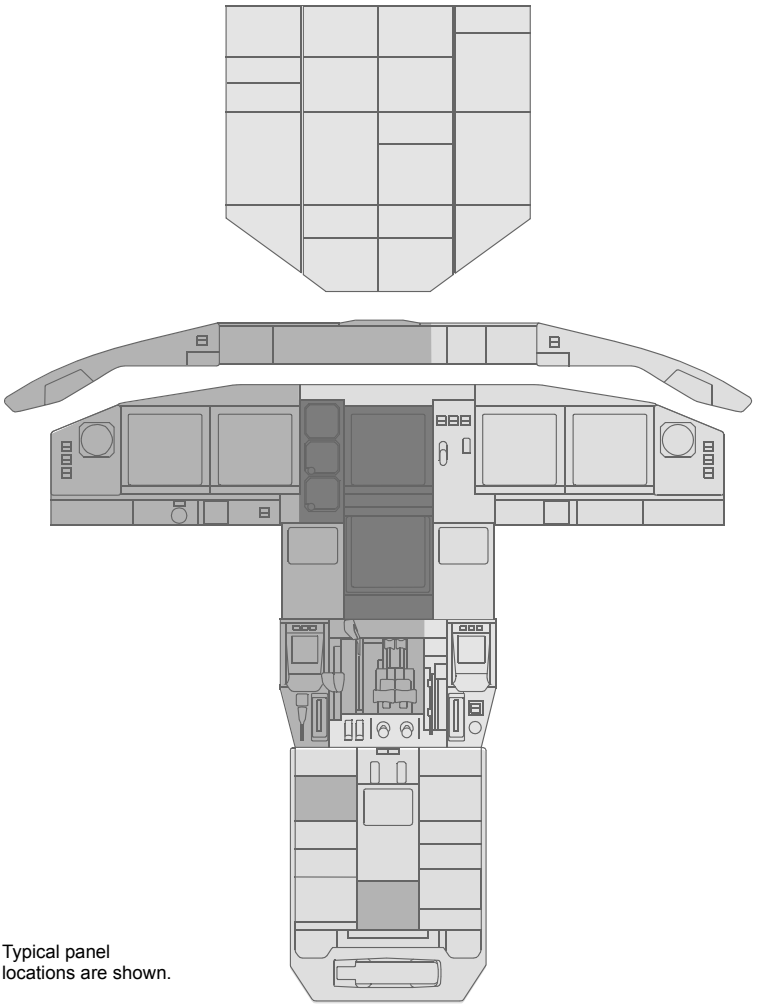
The scan flow diagram provides general guidance on the order each flight crew member should follow when doing the preflight and postflight procedures. Specific guidance on the items to be checked are detailed in the amplified Normal Procedures.

Copyright © Delta Air Lines, Inc. See title page for details.



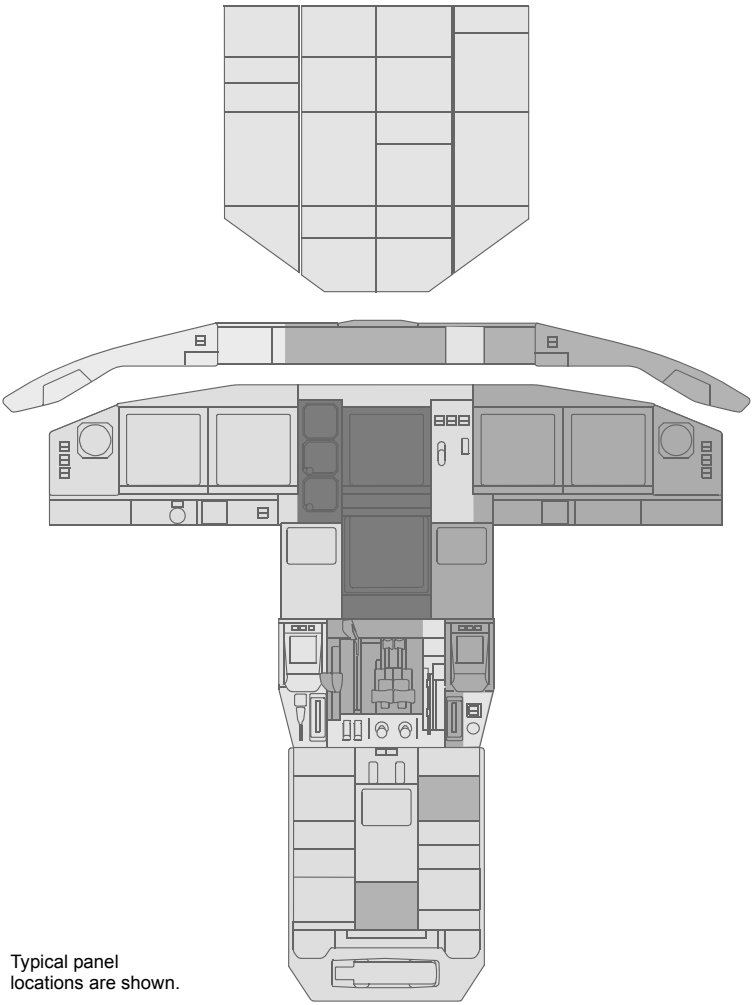
Copyright © Delta Air Lines, Inc. See title page for details.

Areas of Responsibility - Captain as Pilot Flying



Copyright © Delta Air Lines, Inc. See title page for details.

Areas of Responsibility - First Officer as Pilot Flying



Copyright © Delta Air Lines, Inc. See title page for details.

Intentionally
Blank

Copyright © Delta Air Lines, Inc. See title page for details.

Preliminary Preflight Procedure – Captain or First Officer

It is the responsibility of the Flight Leader to verify the cabin emergency equipment inspection is completed and convey this information to the flight deck crew.

For flights without a Flight Attendant staff, refer to the Supplementary Airplane General section, Cabin Inspection Procedure.

The Preliminary Preflight Procedure assumes that the Electrical Power Up supplementary procedure is complete.

WARNING: If a red A/C Out-of-Service tag is installed, personnel are not to activate any system, control, switch, or circuit breaker without obtaining approval of Maintenance personnel (preferably the AMT actually performing the repairs)

ADIRU switch .....ON

Refer to the Supplementary Flight Management, Navigation section for ADIRU alignment instructions.

Verify that the ON BAT light is extinguished.

Verify that the OFF light is extinguished.

STATUS display ..... Check

Verify that only expected messages are shown.

Verify that the following are sufficient for flight:

- oxygen pressure
- hydraulic quantity (no RF displayed)
- engine oil quantity

Logbooks and manuals ..... Check

Check the aircraft logbook to become familiar with the history and maintenance status of the aircraft.

- Ensure the Airworthiness Release has been signed by Maintenance.
- Ensure Predeparture check is recorded prior to ETOPS departure.

Copyright © The Boeing Company. See title page for details.

- MCOs should be reviewed, using the MDM, to ensure compliance when special operating procedures are applicable.

Ensure the following documents are on-board:

- Aircraft logbook (blue)
- Quick Reference Handbook (QRH) (2 copies) (clear ring binder)
- Operations Manual Volume 2 (yellow)
- Flight Crew Training Manual (FCTM) (small black binder)
- Mechanical Dispatch Manual (MDM) (orange)
- Performance Log (green)
- Offline Airports Airway Manual ("the Brick")
- Operational Data Manual (ODM) (light blue)
- Aircraft Restrictions Manual (ARM) (black)
- Fault Reporting Manual (FRM) (grey).

Note: The effective dates for all checklists and manuals may be found under the DBMS - CURRENT PUBS menu, or by clicking the REVISIONS link on the appropriate My Delta Fleet webpage in the Delta Flight Operations portal.

Ships 7101 & Subsequent

FLIGHT DECK ACCESS SYSTEM ..... OFF

Guard up, switch up.

Ships 7001 – 7008

Mechanical Latch Pin ..... As required

Flight Deck Emergency equipment ..... Check

Fire extinguisher – Checked and stowed

- trigger safety pin in place
- green disk in place
- properly stowed.

Crash axe – Stowed

Escape ropes – Stowed

PBE – Checked and stowed

Life vests – Stowed

Ships 7001 – 7008

Emergency Locator Transmitter (ELT) – Stowed

Copyright © The Boeing Company. See title page for details.

Box type portable ELT (as installed)
ELT switch – ARMED

Jump seat harnesses ..... Secure

Crew luggage ..... Secure

Overhead maintenance panel ..... Guards closed

Verify that all lights are extinguished.

Ships 7001 – 7008
MEDICAL OUTLET POWER switch – As required

CARGO TEMPERATURE selectors – As required

Normally, AFT set to LOW and BULK set to HIGH.

COCKPIT VOICE RECORDER ..... Check

Refer to Supplementary Procedures, Communications section, Cockpit Voice Recorder Test.

Circuit breakers ..... Check

Door 1 Upper Crew Rest Compartment ..... Check

Pilots will preflight the Door 1 Upper Crew Rest Compartment emergency equipment prior to each international departure, and on the first domestic flight of each day. Flight Attendants are responsible for the preflight of the Door 3 or Door 4 Upper Crew Rest Compartment.

Fire extinguishers (2 halon, 1 H2O) – Checked and stowed

- trigger safety pin in place
- green disk in place
- properly stowed.

PBEs (4) – Checked and stowed

First Aid Kit – Stowed

Verify seal in place.

Oxygen bottle – Checked and stowed

Flashlight - Checked and stowed

Refer to Supplementary Airplane General, Emergency Equipment, Doors, Windows section, Upper Crew Rest Compartments for additional information.

Copyright © The Boeing Company. See title page for details.

Exterior Inspection

A flight crew member shall make a complete exterior inspection, review the aircraft logbook, and report any discrepancy to the Captain and to Maintenance as soon as possible. Emphasis should be placed on tire wear, airframe/control damage, or leaking fluids.

Before each flight the Captain or First Officer must verify that the airplane is satisfactory for flight.

Items at each location may be checked in any sequence.

Use the detailed inspection route below to check that:

- the surfaces and structures are clear, not damaged, not missing parts and there are no fluid leaks
- installed placards are readable
- the tires are not too worn, not damaged, and there is no tread separation

  Note: Notify maintenance if:

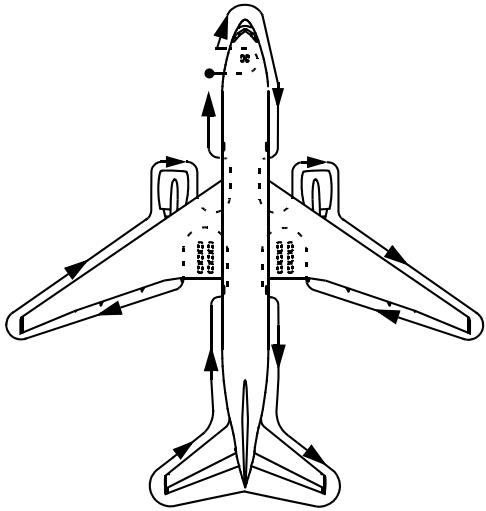
  - any tread groove is worn competely around the tire
  - any layer of cord is showing
  - any questionable cut exists
  - any appearance of improper inflation
  - any wheel through-bolt or nut is missing or damaged.
- the gear struts are not fully compressed
- the engine inlets and tailpipes are clear, the access panels are secured, the exterior is not damaged, and the reversers are stowed
- the doors and access panels that are not in use are latched
- the probes, vents, and static ports are clear and not damaged
- the skin area adjacent to the pitot probes and static ports is not wrinkled
- the antennas are not damaged
- the light lenses are clean and not damaged

For cold weather operations see the Supplementary Procedures, Adverse Weather section.

Copyright © The Boeing Company. See title page for details.

Check the following specific items during the exterior inspection

Inspection Route



Left Forward Fuselage

Probes, sensors, ports, vents, and drains (as applicable) ..... Check

Doors and access panels (not in use) .....Latched

Oxygen pressure relief green disc .....In place

Forward outflow valve..... Check

Nose

Windshield wipers stowed ..... Check

Radome ..... Check

Diverter strips - Secure

Forward access door .....Secure

Nose Wheel Well

Tires and wheels ..... Check

Gear strut and doors..... Check

Nose wheel steering assembly ..... Check

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Gear pin ..... Not installed

Nose gear towing lever and pin ..... As required
If towbar is attached, towing lever set to bypass, pin installed.

Exterior lights ..... Check

Nosewheel spin brake (snubbers) ..... Installed

Wheel well light switches ..... As required

Forward E and E door ..... Secure

Right Forward Fuselage

Probes, sensors, ports, vents, and drains (as applicable) ..... Check

Doors and access panels (not in use) ..... Latched

Negative pressure relief vents ..... Closed

Right Wing Root, Pack, and Lower Fuselage

Probes, sensors, ports, vents, and drains (as applicable) ..... Check

Exterior lights ..... Check

Pack inlet and pneumatic access doors ..... Secure

Leading edge flaps ..... Check

Right Engine

Access panels ..... Latched

Probes, sensors, ports, vents, and drains (as applicable) ..... Check

Fan blades, probes, and spinner ..... Check

Thrust reverser ..... Stowed

Exhaust area and tailcone ..... Check

Right Wing and Leading Edge

Access panels ..... Latched

Fuel panel (not in use) ..... Latched

Copyright © The Boeing Company. See title page for details.

Leading edge slats ..... Check

Fuel measuring sticks ..... Flush and secure

Wing Surfaces ..... Check

Fuel tank vent ..... Check

Right Wing Tip and Trailing Edge

Navigation and strobe lights ..... Check

Static discharge wicks ..... Check

Fuel jettison nozzle ..... Check

Aileron, flaperon, and trailing edge flaps ..... Check

Right Main Gear

Tires, brakes and wheels ..... Check

Verify that the wheel chocks are in place as required.

If the parking brake is set, the brake wear indicator pins must extend out of the guides.

Main gear steering bypass ..... Check

Verify bypass is in NORMAL position.

Gear strut, actuators, and doors ..... Check

Hydraulic lines ..... Secure

Gear pins ..... Not installed

Right Main Wheel Well

Wheel well ..... Check

Right Aft Fuselage

Ram air turbine door ..... Check

Doors and access panels (not in use) ..... Latched

Probes, sensors, ports, vents, and drains (as applicable) ..... Check

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Tail

Tail strike sensor ..... Check

Vertical stabilizer and rudder ..... Check

Horizontal stabilizer and elevator ..... Check

Static discharge wicks ..... Check

Strobe light ..... Check

APU exhaust outlet ..... Check

Left Aft Fuselage

Aft outflow valve ..... Check

Doors and access panels (not in use) ..... Latched

Probes, sensors, ports, vents, and drains (as applicable) ..... Check

Left Main Wheel Well

Wheel well ..... Check

Left Main Gear

Tires, brakes and wheels ..... Check

Verify that the wheel chocks are in place as required.

If the parking brake is set, the brake wear indicator pins must extend out of the guides.

Main gear steering bypass ..... Check

Verify bypass is in NORMAL position.

Gear strut, actuators and doors ..... Check

Hydraulic lines ..... Secure

Gear pins ..... Not installed

Left Wing Tip and Trailing Edge

Navigation and strobe lights ..... Check

Static discharge wicks ..... Check

Copyright © The Boeing Company. See title page for details.

Aileron, flaperon, and trailing edge flaps ..... Check

Fuel jettison nozzle ..... Check

Fuel tank vent ..... Check

Left Wing and Leading Edge

Wing Surfaces ..... Check

Fuel measuring sticks ..... Flush and secure

Fuel tank vent ..... Check

Leading edge slats ..... Check

Access panels ..... Latched

Left Engine

Exhaust area and tailcone ..... Check

Thrust reverser ..... Stowed

Probes, sensors, ports, vents, and drains (as applicable) ..... Check

Access panels ..... Latched

Fan blades, probes, and spinner ..... Check

Left Wing Root, Pack, and Lower Fuselage

Probes, sensors, ports, vents, and drains (as applicable) ..... Check

Exterior lights ..... Check

Pack inlet and pneumatic access doors ..... Secure

Negative pressure relief vents ..... Closed

Positive pressure relief valves ..... Closed

Leading edge flaps ..... Check

Copyright © The Boeing Company. See title page for details.

Intentionally
Blank

Copyright © The Boeing Company. See title page for details.

CDU Preflight Procedure - Pilot Flying

The Initial Data and Navigation Data entries must be complete before the flight instrument check during the Preflight Procedure. The Performance Data entries must be complete before the Before Start Checklist.

Normally, this procedure is accomplished by the Pilot Flying (PF), however, it does not preclude the Pilot Monitoring (PM) from completing all or part of the procedure if time and conditions dictate.

Enter data in all the boxed items on the following CDU pages.

Enter data in the dashed items or modify small font items that are listed in this procedure. Enter or modify other items at pilot's discretion.

Failure to enter enroute winds can result in flight plan time and fuel burn errors.

After completing this procedure, the PF should confirm the flight deck set-up accomplished by the PM.

Initial Data .....Set

IDENT page:

Verify that the MODEL is correct.

Verify that the ENG RATING is correct.

Verify that the navigation data base ACTIVE date range is current.

POS INIT page:

Verify that the time is correct.

Enter the present position on the SET INERTIAL POS line. Use the most accurate latitude and longitude.

Navigation Data .....Set

RTE page:

Enter the route.

Refer to the Supplementary Flight Management, Navigation section for waypoint loading procedures.

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Enter “DAL” then FLIGHT NUMBER.

Activate and execute the route.

DEPARTURES page:

Select the runway and departure routing.

Execute the runway and departure routing.

Verify that the route is correct on the RTE page. Check the LEGS pages as required to ensure compliance with the flight plan.

Verify or enter the correct RNP for the departure (if required).

NAV RADIO page:

Tune the navigation radios as required.

Performance Data ..... Set

PERF INIT page:

CAUTION: Do not enter the ZFW into the GR WT boxes. The FMC will calculate performance data with significant errors.

Enter gross weight data.

If fueling is complete:

Verify that the FUEL on the CDU, the fuel service record, and EICAS agree.

Verify that the fuel is sufficient for flight.

Verify that the GR WT on the CDU and the dispatch papers agree.

THRUST LIM page:

Select an assumed temperature as required.

Ships 7101 & Subsequent
Select the APU to pack mode, as required.

Select a full or a derated climb thrust as required.

Copyright © The Boeing Company. See title page for details.

TAKEOFF REF page:

Make data entries on page 2/2 before page 1/2.

Departure briefing ..... Complete

Refer to the FOM for expanded briefing information.

Copyright © The Boeing Company. See title page for details.

Preflight Procedure – Pilot Monitoring

Normally this procedure is accomplished by the Pilot Monitoring (PM). However, this does not preclude the Pilot Flying (PF) from completing all or part of the procedure if time and conditions dictate.

WARNING: If a red A/C Out-of-Service tag is installed, personnel are not to activate any system, control, switch, or circuit breaker without obtaining approval of Maintenance personnel (preferably the AMT actually performing the repairs)

First Flight of the Day Items (if required) ..... Check

The following item(s) need only be accomplished prior to the first flight each day (after midnight) local time.

Supplementary Procedure	Location
FLIGHT DECK ACCESS SYSTEM	Airplane General, Emergency Equipment, Doors, Windows
FIRE WARNING SYSTEM (only on non-ETOPS flights)	Fire Protection

THRUST ASYMMETRY COMPENSATION switch ..... AUTO

Verify that the OFF light is extinguished.

PRIMARY FLIGHT COMPUTERS DISCONNECT switch ..... Guard closed

Verify that the DISC light is extinguished.

ELECTRICAL panel ..... Set

BATTERY switch – ON

Verify that the OFF light is extinguished.

Ships 7008, 7101 and Subsequent
IFE/PASS SEATS power switch – ON

Verify that the OFF light is extinguished.

Ships 7008, 7101 and Subsequent
CABIN/UTILITY power switch – ON

Verify that the OFF light is extinguished.

Copyright © The Boeing Company. See title page for details.

APU GENERATOR switch – ON

Verify that the OFF light is extinguished.

BUS TIE switches – AUTO

Verify that the ISLN lights are extinguished.

GENERATOR CONTROL switches – ON

Verify that the OFF lights are illuminated.

Verify that the DRIVE lights are illuminated.

BACKUP GENERATOR switches – ON

The OFF lights stay illuminated until the respective engine is started.

APU selector (as required) ..... START, then ON

Do not allow the APU selector to spring back to the ON position.

Verify that the FAULT light is extinguished.

L WIPER selector ..... OFF

Ships 7001 – 7008

DOOR LOCK CONTROLLER selector .....AUTO

Ships 7101 & Subsequent

ELT switch .....Guard closed

EMERGENCY LIGHTS switch .....Guard closed

SERVICE INTERPHONE switch ..... OFF

PASSENGER OXYGEN ON light ..... Verify extinguished

Note: Do not push the PASSENGER OXYGEN switch. The switch causes deployment of the passenger oxygen masks.

WINDOW HEAT switches .....ON

Verify that the INOP lights are extinguished.

RAM AIR TURBINE UNLOCKED light ..... Verify extinguished

WARNING: Do not push the RAM AIR TURBINE switch. The switch causes deployment of the ram air turbine.

HYDRAULIC panel .....Set

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

LEFT and RIGHT ENGINE PRIMARY pump switches – ON
Verify that the FAULT lights are illuminated.

Center 1 and Center 2 ELECTRIC PRIMARY pump switches – OFF
Verify that the FAULT lights are illuminated.

DEMAND pump selectors – OFF
Verify that the FAULT lights are illuminated.

PASSENGER SIGNS panel ..... Set

Ships 7001 – 7008
NO SMOKING selector – ON

All
SEAT BELTS selector – ON

Lighting panel ..... Set

OVERHEAD/CIRCUIT BREAKER panel light control – Mid position

DOME light control – As required

STORM light switch – As required

MASTER BRIGHTNESS switch – ON

MASTER BRIGHTNESS control – As required

GLARESHIELD PANEL/FLOOD light control – Mid position

LANDING light switches – OFF

APU fire panel ..... Set

Prior to the aircraft's first flight of the day, if flight is a non-ETOPS flight, perform a Fire Warning Test. Refer to the Supplementary Fire Protection section for procedure.

Verify that the APU BTL DISCH light is extinguished.

APU fire switch – In
Verify that the APU fire warning light is extinguished.

Copyright © The Boeing Company. See title page for details.

CARGO FIRE panel ..... Set

CARGO FIRE ARM switches – Off

Verify that the FWD and AFT fire warning lights are extinguished.

Verify that the cargo fire DISCH light is extinguished.

ENGINE panel ..... Set

EEC MODE switches – NORM

START selectors – NORM

AUTOSTART switch – ON

Verify that the OFF light is extinguished.

FUEL JETTISON panel ..... Set

FUEL JETTISON NOZZLE switches – Off

Verify that the VALVE lights are extinguished.

FUEL TO REMAIN selector – IN

FUEL JETTISON ARM switch – Off

Verify that the FAULT light is extinguished.

FUEL panel ..... Set

Ensure fueling is in progress or complete.

CROSSFEED switches – OFF

Verify that the VALVE lights are extinguished.

FUEL PUMP switches – OFF

Verify that the left forward pump PRESS light is extinguished if the APU is on or is illuminated if the APU is off.

Verify that the other left and right pump PRESS lights are illuminated.

Verify that the center pump PRESS lights are extinguished.

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

ANTI–ICE panel ..... Set

WING anti–ice selector – AUTO

ENGINE anti–ice selectors – AUTO

Lighting panel ..... Set

BEACON light switch – OFF

NAVIGATION light switch – ON

LOGO light switch – As required

WING light switch – As required

INDICATOR LIGHTS switch – As required

RUNWAY TURNOFF light switches – OFF

TAXI light switch – OFF

STROBE light switch – OFF

AIR CONDITIONING panel ..... Set

EQUIPMENT COOLING switch – AUTO
Verify that the OVRD light is extinguished.

GASPER switch – ON

RECIRCULATION FANS switches – ON

FLIGHT DECK TEMPERATURE control – mid AUTO position

CABIN TEMPERATURE control – Mid position

PACK switches – AUTO
Verify that the OFF lights are extinguished.

TRIM AIR switches – ON
Verify that the FAULT lights are extinguished.

Copyright © The Boeing Company. See title page for details.

BLEED AIR panel ..... Set

LEFT, CENTER and RIGHT ISOLATION switches – AUTO

Verify that the CLOSED lights are extinguished.

ENGINE bleed switches – ON

The OFF lights stay illuminated until the respective engine is started.

APU bleed switch – AUTO

Verify that the OFF light is extinguished.

PRESSURIZATION panel ..... Set

OUTFLOW VALVE switches – AUTO

Verify that the MAN lights are extinguished.

LANDING ALTITUDE selector – IN

R WIPER selector ..... OFF

Mode control panel ..... Set

FLIGHT DIRECTOR switches – ON

AUTOTHROTTLE ARM switches – ARM

Autopilot DISENGAGE bar – Up

HEADING/TRACK reference switch – HDG

BANK LIMIT selector – AUTO

VERTICAL SPEED/FLIGHT PATH ANGLE reference switch – As required.

ALTITUDE increment selector – As required

Display select panel ..... Set

LOWER CENTER display switch – Push

HEADING REFERENCE switch ..... NORM

FMC selector ..... AUTO

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Ships 7001 – 7008

Standby instruments ..... Check

Set local altimeter setting.

Verify that the flight instrument indications are correct.

Verify that no flags or messages are shown.

Verify not blank.

Ships 7101 & Subsequent

Integrated standby flight display ..... Set

Verify that the approach mode display is blank.

Set local altimeter setting.

Verify that the flight instrument indications are correct.

Verify that no flags or messages are shown.

Landing gear panel ..... Set

Verify that the GND PROX light is extinguished.

FLAP OVERRIDE switch – Off

GEAR OVERRIDE switch – Off

TERRAIN OVERRIDE switch – Off

Landing gear lever – DN

ALTERNATE GEAR switch – Guard closed

AUTOBRAKE selector – RTO

EICAS display ..... Check

Verify that the primary engine indications show existing conditions.

Verify that no exceedance is shown.

Fuel required ..... ___ onboard ___

For the blanks, verbalize flight plan block fuel and actual fuel on-board.

MFD ..... Check

Secondary ENGINE indications – Check

Verify that the secondary engine indications show existing conditions.

Copyright © The Boeing Company. See title page for details.

Verify that no exceedance is shown.

STATUS display switch – Push.

Check status messages.

Note: The following steps apply when the electronic checklist is operational.

CHECKLIST display switch – Push

LOWER CENTER cursor location switch – Push

Verify that the lower center cursor location light is illuminated.

RESETS – Select

RESET ALL – Select

Center DISPLAY CONTROL source switch ..... Off

CENTER PANEL BRIGHTNESS controls ..... Mid position

ALTERNATE PITCH TRIM levers .....Neutral

SPEEDBRAKE lever ..... DOWN

Reverse thrust levers .....Down

Forward thrust levers .....Closed

Flaps .....UP

The flap position indicator does not show when the flaps are up.

Set the flap lever to agree with the flap position.

Parking brake .....Set

Verify that the PARKING BRAKE SET message is shown.

Note: Do not assume that the parking brake will prevent airplane movement. Accumulator pressure can be insufficient.

STABILIZER cutout switches .....Guards closed

FUEL CONTROL switches ..... CUTOFF

FUEL CONTROL switch fire warning lights ..... Verify extinguished

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

ALTERNATE FLAPS panel ..... Set

ALTERNATE FLAPS ARM switch – OFF

ALTERNATE FLAPS selector – OFF

Engine fire panel ..... Set

Verify that the ENG BTL 1 DISCH and ENG BTL 2 DISCH lights are extinguished.

Engine fire switches – In

Verify that the LEFT and RIGHT fire warning lights are extinguished.

Radios, transponder, radar ..... Check and set

Left radio tuning panel – Set

Verify that the OFF light is extinguished.

Set frequencies as required.

Right radio tuning panel – Set

Verify that the OFF light is extinguished.

WEATHER RADAR panel – Set

Center radio tuning panel – Set

Verify that the OFF light is extinguished.

Set frequencies as required.

Observer's audio control panel – As required

OBSERVER AUDIO selector – NORM

Transponder panel – Set

Center CDU ..... Set

Flight deck printer ..... Set

Verify that the PAPER light is extinguished.

Ships 7101 & Subsequent

FLIGHT DECK DOOR selector ..... AUTO

Evacuation COMMAND switch ..... Guard closed

Copyright © The Boeing Company. See title page for details.

FLOOR LIGHTS switch ..... As required

AISLE STAND PANEL light control ..... Mid position

AISLE STAND FLOOD light control ..... Mid position

WARNING: Do not put objects between the seat and the aisle stand. Injury can occur when the seat is adjusted.

Copyright © The Boeing Company. See title page for details.

Preflight Procedure – Captain and First Officer

Unless designated otherwise, the following steps are to be accomplished in each pilot's area of responsibility.

EFIS control panel ..... Set

MINIMUMS reference selector – RADIO or BARO

MINIMUMS selector – As desired

FLIGHT PATH VECTOR switch – As required

METERS switch – As required

BAROMETRIC reference selector – IN or HPA

BAROMETRIC selector – Set local altimeter setting on PFD

VOR/ADF switches – As required

ND mode selector – MAP

ND CENTER switch – As required

ND range selector – As required

ND TRAFFIC switch – ON

TCAS OFF will display on NDs until TCAS is set to TA or TA/RA.

WEATHER RADAR – Off

Verify that the weather radar indications are not shown on the ND.

Map switches – As required

Oxygen masks, regulator, interphone ..... Check

Prior to the first flight of the day, perform an observer's oxygen mask test. Refer to Supplementary, Airplane General section for procedure.

Ships 7101 & Subsequent

ELECTRONIC FLIGHT BAGs (if installed) ..... Set

PWR – On

IDENT page – Check

Copyright © The Boeing Company. See title page for details.

INITIALIZE FLIGHT – Select

ORIGIN Chart Clip – Set

If the EFB Terminal Charts application will be used for departure, ensure all necessary charts are included in the Origin Chart Clip prior to pushback.

Windows ..... Check

Verify the lock lever is in the locked (forward) position and the orange indicator is not in view.

MAP light control ..... As required

Heaters .....Set

SHOULDER control and FOOT selector - As required

FORWARD PANEL BRIGHTNESS controls ..... Mid position

Instrument source select panels .....Set

NAVIGATION source switch – Off

DISPLAY CONTROL source switch – Off

AIR DATA/ATTITUDE source switch – Off

Clocks .....Set

Time/date selector – UTC

Altimeters ..... ___, xck

For the blank, verbalize the correct altimeter setting.

Verify altimeters meet accuracy requirements of RVSM airspace.

Refer to Limitations chapter, Airplane General, RVSM Operations for additional information.

INBOARD DISPLAY selectors ..... MFD

Do the Initial Data and Navigation Data steps from the CDU Preflight Procedure and verify that the IRS alignment is complete before checking the flight instruments.

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Flight & nav instruments ..... Check

Verify that the flight instrument indications are correct.

Verify that only these flags are shown:
- TCAS OFF
- NO VSPD until takeoff V–speeds are selected

Verify that the flight mode annunciations are correct:
- autothrottle mode is blank
- roll mode is TO/GA
- pitch mode is TO/GA
- AFDS status is FLT DIR
- VNAV and/or LNAV armed (as required).

Verify route is displayed and correct.

Select the map mode.

Audio control panels ..... As required

WARNING: Do not put objects between the seat and the aisle stand. Injury can occur when the seat is adjusted.

Seats ..... Adjust

Adjust the seat for optimum eye reference.

Rudder pedals ..... Adjust

Adjust the rudder pedals to allow full rudder pedal and brake pedal movement. Stow the rudder pedal adjust crank.

Seat belt and shoulder harnesses ..... Adjust

Flight Attendant briefing ..... Complete

Refer to the FOM for expanded briefing information.

Call for “BEFORE START CHECKLIST.”

Read the BEFORE START checklist up to “When paperwork received:” items.

Copyright © The Boeing Company. See title page for details.

Before Start Procedure

This procedure is accomplished after papers are on board, flight crew is ready for pushback, and/or engine start. Two crewmembers must refer to final AWABS/WDR to verify takeoff performance and configuration data.

Do the CDU Preflight Procedure – Performance Data steps before completing this procedure.

CDU .....Set

INIT REF key – Push

Displays INITIALIZATION/REFERENCE INDEX page.

PERF – Select

Displays PERF INIT page.

Verify fuel quantities agree between EICAS and CDU.

Enter Zero Fuel Weight (ZFW).

Check fuel freeze temperature value.

If correct value is not displayed, enter freeze point temperature for the type of fuel being used.

THRUST LIM – Select

Selection displays THRUST LIMIT page.

CAUTION: Do not use Assumed Temperature (AT) thrust when:
- **Restricted at particular airports - refer to Delta Airway Manual 10-0 Special Pages.**
- **Unstable weather conditions exist.**
- **AWABS system is inoperative.**

Ships 7101 & Subsequent

Select takeoff thrust:
- full thrust, or
- Assumed Temperature, or
- fixed derate, or
- Assumed Temperature with a fixed derate.

Note: Refer to the Supplementary APU-to-Pack, Double Derate, and Takeoff Bump Thrust for instructions.

Copyright © The Boeing Company. See title page for details.

Ships 7001 – 7008

Select takeoff thrust:

- full thrust, or
- Assumed Temperature.

TAKEOFF – Select

Selection displays TAKEOFF REF page 1/2

NEXT PAGE – Select

Selection displays page 2/2 of the TAKEOFF REF page.

Verify ENGINE OUT ACCELERATION HEIGHT.

Verify ACCELERATION HEIGHT.

Verify THRUST REDUCTION height.

PREVIOUS PAGE – Select

Selection displays TAKEOFF REF page 1/2

Enter FLAPS setting.

Check Assumed Temperature.

Enter CG value.

Check RUNWAY/POSITION (if intersection takeoff.).

Check V1, VR, V2 speeds.

Verify “V” speeds match AWABS data.

CDU display – Set

Normally the PF selects the TAKEOFF REF or VNAV CLIMB page.

Normally the PM selects the LEGS page.

Mode Control Panel ..... Set

IAS/MACH selector – Set V2

Arm LNAV as required.

Arm VNAV.

Initial heading or track – Set

Initial altitude – Set

Copyright © The Boeing Company. See title page for details.

Ships 7101 & Subsequent

EFB AIRPORT MAP application (if installed) ..... Select

Select map as desired:

- Display the Airport Moving Map (if available), or
- Display appropriate 10-9 Terminal Chart.

CAUTION: Do not use the Airport Map application as a primary navigation reference. The Airport Map application is designed to aid flight crew positional awareness only.

Complete the remaining BEFORE START checklist items.

Copyright © The Boeing Company. See title page for details.

Intentionally
Blank

Copyright © The Boeing Company. See title page for details.

Pushback/Start Procedure

The engines may be started during pushback or towing.

Exterior doors .....Verify closed

Verify DOORS message not annuciated on EICAS.

Cabin preparations ..... Complete

Ensure “CABIN IS READY FOR PUSHBACK” is received from Flight Leader.

HYDRAULIC panel .....Set

Note: Pressurize the right system first to prevent fluid transfer between systems.

Right ELECTRIC DEMAND pump selector – AUTO

Verify that FAULT light is extinguished.

Center 1 and Center 2 ELECTRIC PRIMARY pump switches – ON

Verify that the Center 1 FAULT light is extinguished.

The Center 2 FAULT light may stay illuminated until after engine start because of load shedding.

Note: With only a single ground power source available, including the APU, the C2 PRIMARY pump will not run if the C1 pump is selected ON. The C2 PRIMARY pump FAULT light remains illuminated until an engine generator is operating. The HYD PRESS PRI C2 message is inhibited.

Left ELECTRIC DEMAND pump selector – AUTO

Verify that the FAULT light is extinguished.

Center 1 and Center 2 AIR DEMAND pump selectors – AUTO

Verify that the FAULT lights are extinguished.

Fuel panel .....Set

LEFT and RIGHT FUEL PUMP switches – ON

Verify that the PRESS lights are extinguished.

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Ships 7101 & Subsequent

If there is more than 10,500 pounds of fuel in the center tank:

CENTER FUEL PUMP switches – ON

One or both PRESS lights may stay illuminated until after the engine start because of load shedding.

Note: If there is less than 10,500 pounds of fuel in the center tank, the center tank fuel pumps must remain off until above 10,000 feet.

Ships 7001 – 7008

If there is fuel in the center tank:

CENTER FUEL PUMP switches – ON

One or both PRESS lights may stay illuminated until after the engine start because of load shedding.

Ships 7101 & Subsequent

FLIGHT DECK ACCESS SYSTEM ..... ON

Switch down, Guard down.

Flight deck door ..... Close and lock

Verify that the flight deck door UNLKD light is extinguished.

Verify that the LOCK FAIL light is extinguished.

Recall ..... Check

CANCEL/RECALL switch – Push

Verify that only the expected alert messages are shown.

CANCEL/RECALL switch – Push

Verify that the messages cancel.

Trim .....___ Units, zero, zero

Stabilizer trim – ___ UNITS

Set the trim for takeoff.

Verify stabilizer trim matches FMS data.

Verify that the trim is in the greenband.

Aileron trim – 0 units

Rudder trim – 0 units

Copyright © The Boeing Company. See title page for details.

Transponder ..... As required

At all U.S. airports:

Select TA/RA.

At all non-U.S. airports:

Select STBY or an active mode as required by local airport operating procedures.

BEACON light switch ..... ON

Turn on immediately prior to aircraft movement or immediately prior to engine start, if starting at gate.

CAUTION: Do not hold or turn the nose wheel tiller during pushback or towing. This can damage the nose gear or the tow bar.

CAUTION: Do not use the brakes to stop the airplane during pushback or towing. This can damage the nose gear or the tow bar.

Call “PUSHBACK/START CHECKLIST”.

Read “PUSHBACK/START checklist

Copyright © The Boeing Company. See title page for details.

Engine Start Procedure

Note: One pilot will accomplish the engine start procedure; the other will monitor outside the cockpit. The Captain will brief start duties and announce the start sequence.

Select the secondary engine display.

Start sequence ..... Announce

Ships 7101 & Subsequent
Engines must be started one at a time.

Ships 7001 – 7008
Both engines may be started at the same time.

Call "START ____ ENGINE (S)"

Engine START selector(s) ..... START

FUEL CONTROL switch(es) ..... RUN

Verify that the oil pressure increases.

Autostart corrects for:

- no EGT rise
- a hot start
- a hung start
- no N1 rotation
- a compressor stall
- a starter shaft failure
- insufficient starter air pressure
- a start time that exceeds the maximum starter duty cycle time.

Do the ABORTED ENGINE START checklist for the following abort start condition:

- there is no oil pressure indication after the EGT increases.

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Log aborted engine starts for the following:

- An autostart attempt fails and is accompanied by a related EICAS message.
- The crew has to manually abort an automatic start attempt.
- A manual start attempt fails.

Note: No logbook entry is required if the autostart system aborts a start, automatically attempts a second start, and the second start is successful.

Taxi out with both engines operating.

After Start Procedure

APU selector ..... OFF

ENGINE ANTI-ICE selectors ..... As required

Recall ..... Check

Verify that only expected alert messages are shown.

Call "AFTER START CHECKLIST."

Read AFTER START checklist.

Copyright © The Boeing Company. See title page for details.

Taxi Procedure

After the agent's salute is accepted by the Captain or First Officer, the First Officer should extend the flaps in preparation for taxi. Only after clear of congested areas, may the First Officer continue with his taxi check flow pattern in anticipations of the Captain calling for the TAXI checklist.

Verify that the ground equipment is clear.

Flaps ..... Set

Move FLAP lever to takeoff setting as required by AWABS, and verify position of flaps on EICAS.

Flight controls ..... Check

Note: To avoid nuisance FLIGHT CONTROLS faults, a complete cycle of the control wheel during the flight control check should be done slowly (more than approximately 6 seconds) and not combined with the check of the pitch controls.

Move the control wheel and the control column to full travel in both directions and verify:

- freedom of movement
- that the controls return to center

Hold the nose wheel tiller during the rudder check to prevent nose wheel movement.

Move the rudder pedals to full travel in both directions and verify:

- freedom of movement
- that the rudder pedals return to center

Call "TAXI CHECKLIST."

Read the TAXI checklist.

Extended ground time:

Consider shutting down one or both engines during an extended ground stop. Do not start APU if only one engine is shut down.

Copyright © The Boeing Company. See title page for details.

Before Takeoff Procedure

Ships 7101 & Subsequent

Engine warm up requirements:

- run the engines for at least 3 minutes
- engine oil temperature must be above the bottom of the temperature scale before takeoff.

Ships 7001 – 7008

Engine warm up requirements:

- run the engines for at least 5 minutes

  Note: If engines have been shut down less than 1.5 hours, then run the engines for at least 3 minutes.

- engine oil temperature must be above the lower amber band before takeoff.

Note: If departure runway has changed, crews should refer to the Supplementary Flight Management, Navigation section (SP.11) for items to be reaccomplished.

Flaps ..... ___, ___

Verify flap lever position and flap indication.

Windows ..... Closed and locked

Verify that the WINDOW NOT CLOSED decal does not show.

Verify that the orange indicator does not show.

Altimeters ..... ___, xck

For the blank, verbalize the correct altimeter setting.

Takeoff briefing ..... Complete

Refer to the FOM for standard briefing items to include MIN FUEL FOR T/O.

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Runway, departure, first fix ..... ___, ___, ___

Verify the selected runway, departure, and associated first fix in the FMS match the latest ATC departure clearance.

Verbalize the runway, departure procedure, and first fix.

Check aircraft versus runway position on ND (maximum 10nm scale.)

Flight Attendants .....Notify & acknowledge

Prior to taking the active runway, the flight crew is required to make a PA announcement informing the Flight Attendants to ensure the cabin is prepared for takeoff.

The Flight Attendants should be given sufficient notification before takeoff to make their final cabin preparations and be seated for departure.

The Flight Leader should verbally confirm that the "CABIN IS READY FOR TAKEOFF."

Takeoff will not be initiated until acknowledgement is received.

Ships 7101 & Subsequent

EFB TERMINAL CHART application (if installed) ..... Select

Display appropriate Departure Terminal Chart after departure runway verification.

Final items:

Note: Normally accomplished when cleared on the runway.

Prior to entering a runway, confirm aircraft location utilizing an outside source such as runway signage, painted runway markings and/or aircraft heading.

Transponder, TCAS, radar ..... Set

Transponder – TA/RA

TCAS – Ensure TFC is displayed on NDs

Radar – As required

Copyright © The Boeing Company. See title page for details.

Exterior lights ..... Set

Refer to FOM Operational Policy chapter, Exterior Lights Usage.

Note: Landing/strobe lights may be turned off when reduced visibility conditions exist, in close proximity to other aircraft awaiting takeoff at night, or when flying through clouds.

Call “BEFORE TAKEOFF CHECKLIST.”

Read the BEFORE TAKEOFF checklist.

Copyright © The Boeing Company. See title page for details.

Takeoff Procedure

Pilot Flying	Pilot Monitoring
Verify that the brakes are released. Align the airplane with the runway.	
Ships 7101 & Subsequent Advance the thrust levers to approximately 55% N1. **Ships 7001 – 7008** Advance the thrust levers to approximately 1.05 EPR. Allow the engines to stabilize.	
Push the TO/GA switch.	
Verify that the correct takeoff thrust is set.	
	Monitor the engine instruments during the takeoff. Call out any abnormal indications. Adjust takeoff thrust before 80 knots as required. During strong headwinds, if the thrust levers do not advance to the planned takeoff thrust by 80 knots, manually advance the thrust levers.
Note: After takeoff thrust is set, the captain's hand must be on the thrust levers until V1.	
Monitor airspeed. Maintain light forward pressure on the control column.	Monitor airspeed and call out any abnormal indications.
Verify 80 knots.	Call "80 KNOTS, HOLD, ENGINE INSTRUMENTS CHECKED."
Verify V1 speed.	Verify the automatic V1 callout or call "V1", then call "VR" and" V2."
At VR, rotate toward 15° pitch attitude. After liftoff, follow F/D commands. Establish a positive rate of climb.	
	Verify a positive rate of climb on the altimeter and call "POSITIVE RATE."
Verify a positive rate of climb on the altimeter and call "GEAR UP."	

Copyright © The Boeing Company. See title page for details.

Pilot Flying	Pilot Monitoring
	Set the landing gear lever to UP.
Above 400 feet radio altitude, call for a roll mode as required.	Select or verify the roll mode.
Engage the autopilot when above the minimum altitude for autopilot engagement. (as required)	
Verify that climb thrust is set.	
Verify acceleration at the acceleration height. Call "FLAPS___" according to the flap retraction schedule.	
	Set the flap lever as directed.
	After flap retraction is complete: Confirm GEAR lever UP and GEAR position indicates UP. Set the WING and ENGINE ANTI-ICE selectors to AUTO.
Call "AFTER TAKEOFF CHECKLIST."	Read the AFTER TAKEOFF checklist.

Copyright © The Boeing Company. See title page for details.

Intentionally
Blank

Copyright © The Boeing Company. See title page for details.

Climb and Cruise Procedure

Complete the After Takeoff Checklist before starting the Climb and Cruise Procedure.

Pilot Flying	Pilot Monitoring
At transition altitude, set and crosscheck the altimeters to standard.	
	At or above 18,000 feet MSL, set the LANDING light switches to OFF.
Call "CLIMB CHECKLIST."	Read the CLIMB checklist.
	If the FUEL IN CENTER message appears, set both CENTER FUEL PUMP switches to ON. When the FUEL LOW CENTER message appears, set both CENTER FUEL PUMP switches to OFF.
	Before the top of descent, modify the active route as required for the arrival and approach. Verify or enter the correct RNP for the arrival.

Copyright © The Boeing Company. See title page for details.

Descent Procedure

Normally, the crew should complete the DESCENT checklist at 18,000 feet, or at top-of-desecent (TOD), whichever comes later.

It is suggested that the flight attendants be notified approximately 20 minutes from landing.

The local altimeter setting may be pre-set on the EFIS control panel.

A transition level below FL180 may be programmed on the FMS DESCENT FORECAST page.

Complete the Descent Procedure by 10,000 feet MSL.

Pilot Flying	Pilot Monitoring
Set the SEATBELT sign selector to ON.	
Accomplish approach briefing. Refer to FOM.	
Review all alert messages. Review all operational notes.	Recall and review all alert messages. Recall and review all operational notes.
	Set the AUTOBRAKE selector to the needed brake setting.
Set the RADIO/BARO minimums as required for the approach per RADIO/BARO minimums chart.	
	Modify active route as required for arrival and approach. Set NAV RAD page as required.
	Approaching 18,000 feet, set the LANDING light switches to ON.
Verify VREF on the APPROACH REF page.	Enter VREF on the APPROACH REF page.
	Set the NAV RADIO page for the approach.
Set altimeters as required and verbalize.	
Do the approach briefing.	
Call “DESCENT CHECKLIST.”	Read the DESCENT checklist.

Copyright © The Boeing Company. See title page for details.

RADIO/BARO Minimums Chart

Approach Type	BARO Min Ref	RADIO Min Ref
ILS to CAT I	Published DA	N/A
CAT II	N/A	Published RA
CAT III	N/A	50 feet
Straight-In (Non-ILS)	Published DA or DDA (MDA+ 50 feet)	N/A
Circle-to-Land	Higher of: Published MDA or Field Elevation + 1,000 feet	N/A
Visual	Approach Minimums (1)	N/A
(1) Set the approach minimums for the instrument approach used to back up the visual approach. If no instrument approach is available, biased out of view.		

Copyright © The Boeing Company. See title page for details.

Approach Procedure

The Approach Procedure is normally started at transition level.

Complete the Approach Procedure before:

- the initial approach fix, or
- the start of radar vectors to the final approach course, or
- the start of a visual approach

Pilot Flying	Pilot Monitoring
Verify correct arrival and approach procedures are selected on the PFD/ND. Update changes to the arrival and approach procedures as required. Update changes to the RNP as required.	
Notify the cabin crew to prepare for landing: At approximately 10,000 feet AFE, or if extensive vectoring is expected, no later than five minute prior to landing: **Ships 7101 & Subsequent** • Cycle the CABIN CHIME switch, sounding four chimes. **Ships 7001 – 7008** • Cycle the NO SMOKING selector twice, sounding four chimes. Verify that the cabin is secure.	
Update the approach briefing as required.	
At transition level, set and crosscheck the altimeters.	
Call “APPROACH CHECKLIST.”	Read the APPROACH checklist.

Copyright © The Boeing Company. See title page for details.

Landing Procedure - ILS

Pilot Flying	Pilot Monitoring
Call "FLAPS___" according to the flap extension schedule.	Set the flap lever as directed.
When on localizer intercept heading: • verify that the ILS is tuned and identified • verify that the LOC and G/S pointers are shown	
Arm the APP mode when cleared for the approach.	
	Call "LOCALIZER ALIVE."
WARNING: When using LNAV to intercept the final approach course, LNAV might parallel the localizer without capturing it. The airplane can then descend on the glide slope with the localizer not captured.	
Use HDG SEL/TRK SEL or HDG HOLD /TRK HOLD to intercept the final approach course as required.	
Verify that the localizer is captured.	
	Call "GLIDE SLOPE ALIVE."
At glide slope alive, call: • "GEAR DOWN" • "FLAPS 20"	
	Set the landing gear lever to DN. Set the flap lever to 20.
Set the SPEEDBRAKE lever to ARM.	
At glide slope capture, call "FLAPS___" as required for landing.	Set the flap lever as directed.
Set the missed approach altitude on the MCP.	
Call "LANDING CHECKLIST."	Read the LANDING checklist.
At the final approach fix or OM, verify the crossing altitude.	
Monitor the approach.	

Copyright © The Boeing Company. See title page for details.

Landing Procedure - Instrument Approach Using VNAV

Note: Refer to the Supplementary Autoflight section (SP.4) for Non-ILS instrument approach information, including V/S and FPA use.

This procedure is not authorized using QFE.

Pilot Flying	Pilot Monitoring
Call "FLAPS __" according to the flap extension schedule.	Set the flap lever as directed.
The recommended roll modes for the final approach are: • for a RNAV or GPS approach use LNAV • for a LOC-BC, VOR, or NDB approach use LNAV • for a LOC, or LDA approach use LOC	
	Verify that the VNAV gradient path (GP) angle is shown on the final approach segment of the LEGS page.
When on the final approach course intercept heading for LOC, LOC-BC, or LDA approaches: • verify that the localizer is tuned and identified • verify that the LOC pointer is shown	
Arm the LNAV or LOC mode.	
WARNING: When using LNAV to intercept the localizer, LNAV might parallel the localizer without capturing it. The airplane can then descend on the VNAV path with the localizer not captured.	
Use LNAV, HDG SEL, TRK SEL, HDG HOLD, or TRK HOLD to intercept the final approach course as required.	
	Call "APPROACHING INBOUND COURSE."
Verify that LNAV is engaged or that the localizer is captured.	

Copyright © The Boeing Company. See title page for details.

Pilot Flying	Pilot Monitoring
Prior to the final approach fix and after ALT, VNAV PTH, or VNAV ALT is annunciated: • set TDZE rounded up to nearest 100 feet on the MCP • select or verify VNAV • select or verify speed intervention	
Approaching glide path, call: "GEAR DOWN" "FLAPS 20"	Set the landing gear lever to DN. Set the flap lever to 20
Set the SPEEDBRAKE lever to ARM.	
Prior to the final approach descent, call "FLAPS __" as required for landing.	Set the flap lever as directed.
At the final approach fix, verify the crossing altitude and crosscheck the altimeters.	
When at least 300 feet below the missed approach altitude, and inside the FAF/OM, set the missed approach altitude on the MCP no later than 1,000 feet AGL.	
Monitor the approach.	
If suitable visual reference is established at DA(H)/DDA, disengage the autopilot. Maintain the glide path to landing.	
Call "LANDING CHECKLIST."	Read the LANDING checklist.

Copyright © The Boeing Company. See title page for details.

Go–Around and Missed Approach Procedure

Pilot Flying	Pilot Monitoring
At the same time: • push the TO/GA switch • call “FLAPS 20”	
	Position the flap lever to 20.
Verify: • the rotation to go–around attitude • that the thrust increases	
	Verify that the thrust is sufficient for the go-around or adjust as required.
	Verify a positive rate of climb on the altimeter and call “POSITIVE RATE.”
Verify a positive rate of climb on the altimeter and call “GEAR UP.”	
	Set the landing gear lever to UP.
Above 400 feet radio altitude, select or verify a roll mode.	Verify that the missed approach altitude is set.
At acceleration height, set speed to the maneuver speed for the planned flap setting or select VNAV.	
Call “FLAPS___” according to the flap retraction schedule.	Set the flap lever as directed.
After flap retraction to the planned flap setting, select FLCH or continue in VNAV as required.	
Verify that climb thrust is set.	
Verify that the missed approach route is tracked.	
Verify that the missed approach altitude is captured.	
Call “AFTER TAKEOFF CHECKLIST.”	Read the AFTER TAKEOFF checklist.

Copyright © The Boeing Company. See title page for details.

Landing Roll Procedure

Pilot Flying	Pilot Monitoring
Monitor the rollout progress.	
Verify correct autobrake operation.	
Verify that the thrust levers are closed. Verify that the SPEEDBRAKE lever is UP.	Verify that the SPEEDBRAKE lever is UP. Call "SPEEDBRAKES UP." If the SPEEDBRAKE lever is not UP, call "SPEEDBRAKES NOT UP."
WARNING: After the reverse thrust levers are raised, a full stop landing must be made. If an engine remains in reverse, safe flight is not possible.	
Without delay, raise the reverse thrust levers to the interlocks and hold light pressure until the interlocks release. Then apply reverse thrust as required.	
At 60 knots, start movement of the reverse thrust levers to reach the reverse idle detent before taxi speed.	Call "60 KNOTS."
After the engines are at reverse idle, move the reverse thrust levers full down.	
Before taxi speed, disarm the autobrakes. Use manual braking as required.	
Before turning off the runway, disconnect the autopilot.	
Ships 7101 & Subsequent **CAUTION: Do not use the Airport Map application as a primary navigation reference. The Airport Map application is designed to aid flight crew positional awareness only.**	

Copyright © The Boeing Company. See title page for details.

After Landing Procedure

Start the After Landing Procedure when clear of the active runway.

Engine cooldown recommendations:

Ships 7101 & Subsequent

- Run the engines for at least 3 minutes.

Ships 7001 – 7008

- Run the engines for at least 1 minute.

Captain	First Officer
The Captain positions or verifies that the SPEEDBRAKE lever is DOWN.	
	Set the STROBE light switch to OFF. Set the LANDING and TAXI light switches as required.
Set the weather radar to off.	
	Set FLIGHT DIRECTOR switches to OFF.
	Set the AUTOBRAKE selector OFF.
	Set the flap lever to UP.
	Set the transponder mode selector as required.
	Set ENGINE ANTI-ICE selectors as required.
	Set FUEL CONTROL switches as required.
	Set the APU selector as required.
Call “AFTER LANDING CHECKLIST.”	Read the AFTER LANDING checklist.

Copyright © The Boeing Company. See title page for details.

Shutdown Procedure

Start the Shutdown Procedure after taxi is complete.

Parking brake ..... Set

Verify that the PARKING BRAKE SET message is shown.

Electrical power ..... Set

If APU power is needed:

Check that the APU RUNNING message is shown.

If external power is needed:

Verify that the PRIMARY EXTERNAL POWER AVAIL light is illuminated.

PRIMARY EXTERNAL POWER switch – Push

Verify that the ON light is illuminated.

If the SECONDARY EXTERNAL POWER AVAIL light is illuminated:

SECONDARY EXTERNAL POWER switch – Push

Verify that the ON light is illuminated.

FUEL CONTROL switches ..... CUTOFF

Ships 7101 & Subsequent

Engines may be shut down after a three minute cool down period.

Ships 7001 – 7008

Engines may be shut down after a one minute cool down period.

If towing is needed, accomplish the following steps when towing is complete.

SEAT BELTS selector ..... OFF

HYDRAULIC panel ..... Set

Note: Depressurize the right system last to prevent fluid transfer between systems.

Center 1 and Center 2 ELECTRIC PRIMARY pump switches – OFF

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Left ELECTRIC DEMAND pump selector – OFF

Center 1, and Center 2 AIR DEMAND pump selectors – OFF

Right ELECTRIC DEMAND pump selector – OFF

FUEL PUMP switches ..... OFF

ANTI-ICE selectors ..... AUTO

Transponder ..... STBY

BEACON light switch ..... OFF

Ships 7101 & Subsequent
EFB CLOSE FLIGHT (if installed) ..... Select

After wheel chocks are in place:

Parking brake ..... As required

Set or release as directed by ground handling personnel, or by specific airport procedure.

Call "SHUTDOWN CHECKLIST."

Read the SHUTDOWN checklist.

After SHUTDOWN checklist is complete:

ADIRU information ..... Enter

Enter appropriate ADIRU information.

ADIRU DRIFT data ..... Log

From the CDU:

MAINT page – Select.

INERTIAL MONITOR – Select

Record DRIFT data.

Status messages ..... Check

Check for messages affecting dispatch. Record messages in the logbook.

Copyright © The Boeing Company. See title page for details.

Note: Disregard EICAS alert and status messages displayed during the PFC self test after hydraulic shutdown. Wait approximately 3 minutes after HYD PRESS SYS L+C+R message is shown before recording status and alert messages in the maintenance log.

Oxygen, hydraulic, and engine oil quantities ..... Check

Ensure sufficient oxygen, hydraulic, and engine oil quantities exist for the next flight. If necessary, make a logbook entry in the IRREG block and notify Maintenance as soon as possible.

Logbook entries ..... Complete

Make required entries for maintenance discrepancies and/or autoland documentation.

Color coded circuit breakers ..... As required

Pull appropriate color coded CBs for estimated time on ground. Refer to placard instructions on panel.

ACARS information ..... Enter

Note: Manually send Flight Summary after opening any cabin entry door.

Ships 7101 & Subsequent

FLIGHT DECK ACCESS SYSTEM ..... OFF

Guard up, switch up.

Ships 7001 – 7008

Mechanical Latch Pin ..... As required

Copyright © The Boeing Company. See title page for details.

Secure Procedure

Note: In line operations, the aircraft may remain powered.

Only accomplish the Secure Procedure when:

- requested by Maintenance or Operations, or
- the aircraft is to remain overnight.

When operating the last flight of any day into a limited or non-maintenance station, accomplish the following:

- If a maintenance discrepancy is noted and entered in the logbook, the MCC must be contacted through the Dispatcher as soon as possible to facilitate corrective action and avoid delays. If a flight crew placard is applicable, it should be installed prior to departing the aircraft.
- Perform a postflight walkaround. Emphasis should be placed on tire condition, fluid leaks, oil quantity, and possible airframe or control surface damage.

If the aircraft will lay over in cold weather, ensure it is configured as described in Supplementary Procedures section 16, Adverse Weather.

ADIRU switch ..... OFF

EMERGENCY LIGHTS switch ..... OFF

PACK switches ..... OFF

Ships 7101 & Subsequent
EFB POWER switch ..... Push

BATTERY switch ..... As required

Before leaving the aircraft:

APU/external power ..... As required

Call “SECURE CHECKLIST.”

Read the SECURE checklist.

Copyright © The Boeing Company. See title page for details.

Flight Pattern Principles

Flight patterns in this section are not designed to be comprehensive in nature. They have been developed as a tool for the experienced crew member. A quick review may be obtained by referencing a flight pattern and its associated text. For a complete analysis of a particular maneuver, the Flight Crew Training Manual should be referenced in addition to the material found in this section.

Flight patterns in this section do not include all standard callouts.

Flight patterns in this section do not include every pilot action recommended to fly a particular flight pattern.

Takeoff Considerations

LNAV Departure

If LNAV is to be used for departure, accomplish the following procedures:

Verify the aircraft symbol is in close proximity to the departure end of the runway symbol on the ND in the 10 nm scale.

- If GPS NAV is on, the TO/GA update function is inhibited.
- If GPS NAV is off, the FMC updates position to the takeoff runway threshold when a TO/GA switch is pushed.
- When an intersection takeoff is made with GPS NAV off, the intersection displacement distance from the runway threshold must be entered on the TAKEOFF REF page.

Copyright © The Boeing Company. See title page for details.

Stabilized Approach Requirements

Maintaining a stable speed, descent rate, and vertical/lateral flight path in landing configuration is commonly referred to as the stabilized approach concept.

Any significant deviation from planned flight path, airspeed, or descent rate must be verbalized. The decision to execute a go-around is no indication of poor performance.

WARNING: Do not attempt to land from an unstable approach.

IMC

At 1,000 feet AGL, and on final, the aircraft must be:
- Configured for landing.
- Maintaining a stabilized descent rate, not to exceed 1,000 FPM.

  Note: If a published approach procedure requires a sink rate greater than 1,000 FPM, a special briefing should be conducted.
- On target airspeed within tolerance, or speed being reduced toward target airspeed if higher was necessary.
- Established on course.

At 500 feet AGL, the aircraft must be:
- On target airspeed within tolerance.

WARNING: These conditions must be maintained throughout the rest of the approach for it to be considered a stabilized approach. If the above criterial cannot be established and maintained, initiate a go around.

At 100 feet HAT for all approaches, the aircraft must be positioned so the cockpit is within, and tracking so as to remain within, the lateral confines of the runway extended.

VMC

At 1,000 feet AGL, and on final, the aircraft must be:
- Configured for landing.
- Maintaining a stabilized descent rate, not to exceed 1,000 FPM.

  Note: If a published approach procedure requires a sink rate greater than 1,000 FPM, a special briefing should be conducted.

Copyright © The Boeing Company. See title page for details.

At 500 feet AGL, the aircraft must be:
- On target airspeed within tolerance.
- Lined up with runway except:
    - Where the instrument approach or local procedures (such as River Visual at DCA) dictate otherwise.
    - Maneuvering (including runway changes). Maneuvering below 500 feet is not recommended unless the Captain has determined the operation to be safe after considering:
        - Descent rate change to acquire glide path not excessive.
        - Runway lateral displacement.
        - Runway threshold stagger.
        - Tailwind/crosswind components.
        - Runway length available.

WARNING: These conditions must be maintained throughout the rest of the approach for it to be considered a stabilized approach. If the above criteria cannot be established and maintained, initiate a go around.

At 100 feet HAT for all approaches, the aircraft must be positioned so the cockpit is within, and tracking so as to remain within, the lateral confines of the runway extended.

Crossing the Runway Threshold

As the aircraft crosses the runway threshold it must be:
- Stabilized within tolerance on target airspeed until arresting descent rate at flare.
- On stabilized flight path using normal maneuvering.
- Positioned to make a normal landing in the touchdown zone, i.e., first 3,000 feet or first third of the runway, whichever is less.

WARNING: Initiate a go-around if the above criteria cannot be maintained.

Copyright © The Boeing Company. See title page for details.

ILS Approach Considerations

For ILS approach considerations and procedures, refer to the Normal Amplified Procedures section (NP.20), Approach Procedure information.

ILS Precision Runway Monitor (PRM) Approach - Breakout Procedures

Note: All "breakouts" must be hand flown.

If ATC calls "TRAFFIC ALERT" during the PRM approach:

A/P ..... Disengage

F/D (both) ..... OFF

Maneuver ..... as directed by ATC

If descending, vertical speed should not exceed 1,000 FPM.

Note: If ATC "breakout" instructions coincide with a TCAS RA, follow the vertical guidance of the RA and the lateral guidance directed by ATC.

When "breakout" complete:

Reset automation to the appropriate level.

Visual Approach and Landing Considerations

FMS/ND Utilization

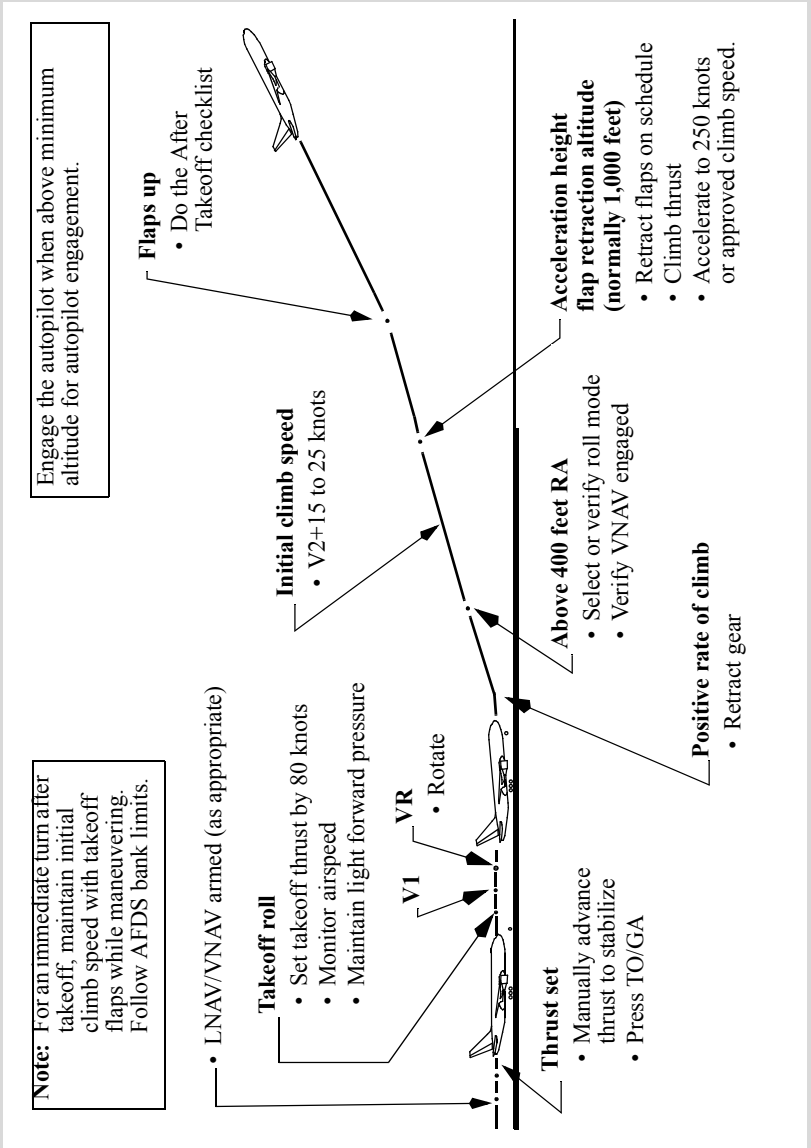
- Using the FMS during visual approaches is optional.
- Program the landing runway as the active waypoint.
- With ND in 10 mile scale, turn to base leg when runway symbol disappears (approximately 4-5 nm from approach end of runway).
- Use distance remaining from runway (if active waypoint) and runway elevation to determine 3 to 1 descent profile.
- Green arc may be used to monitor descent rate.
- Vertical speed or FPV may be utilized for normal descent rate.

Copyright © The Boeing Company. See title page for details.

Flight Profiles

Normal Takeoff (Distant/ICAO NADP 2)

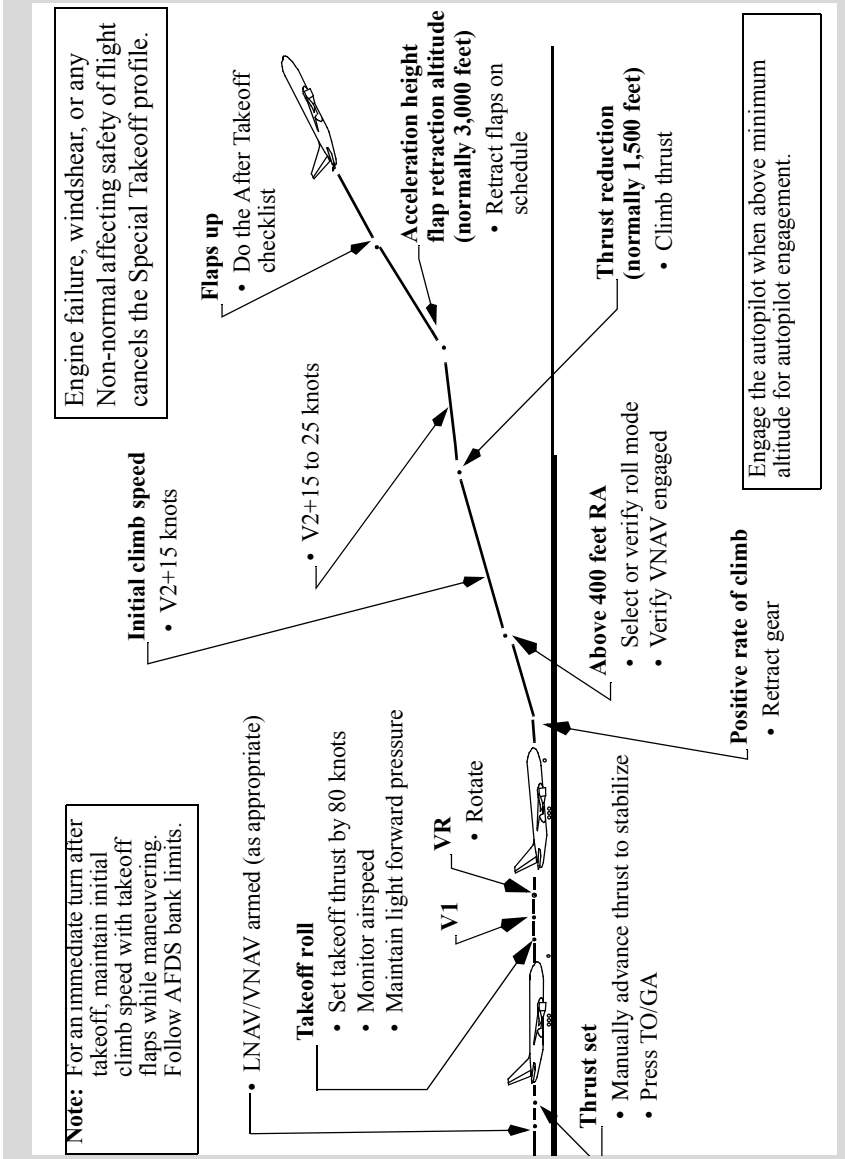
The following profile satisfies typical vertical noise abatement requirements



Copyright © The Boeing Company. See title page for details.

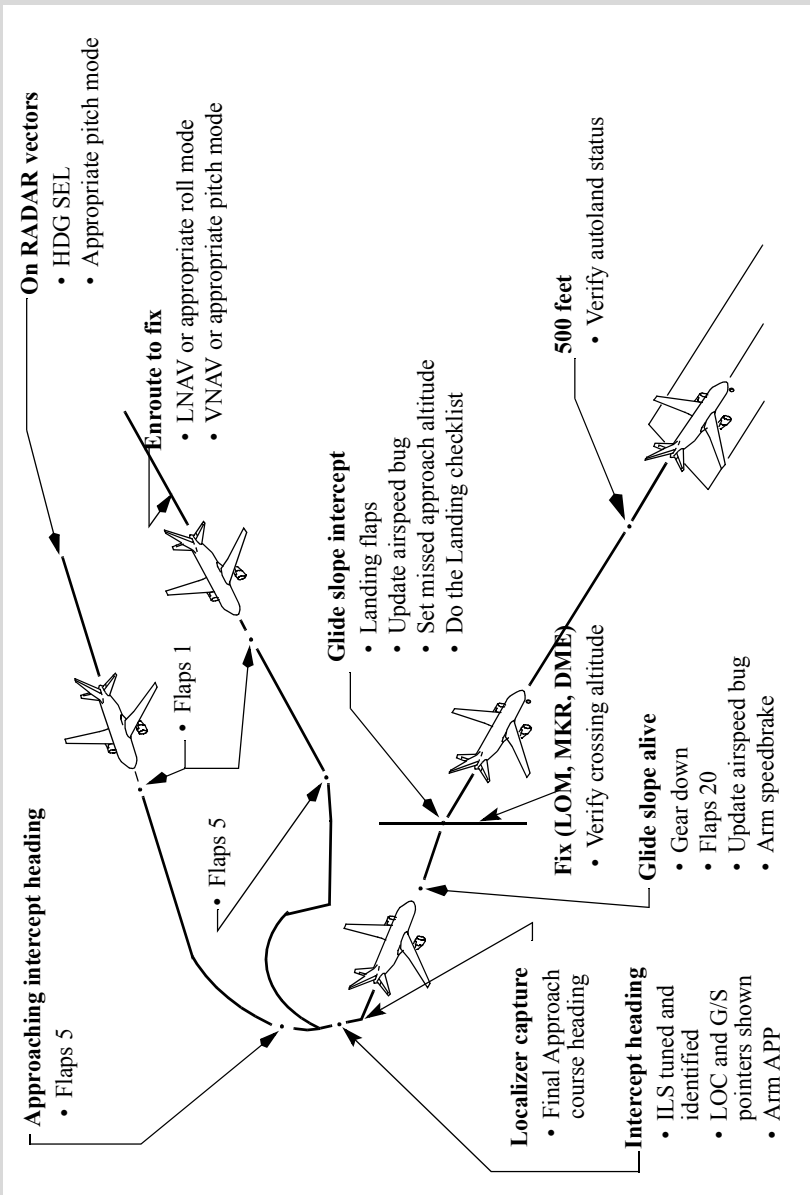
Special Takeoff (Close-In/ICAO NADP 1)

The following profile satisfies typical vertical noise abatement requirements for noise sensitive areas in close proximity to the departure end of an airport runway.



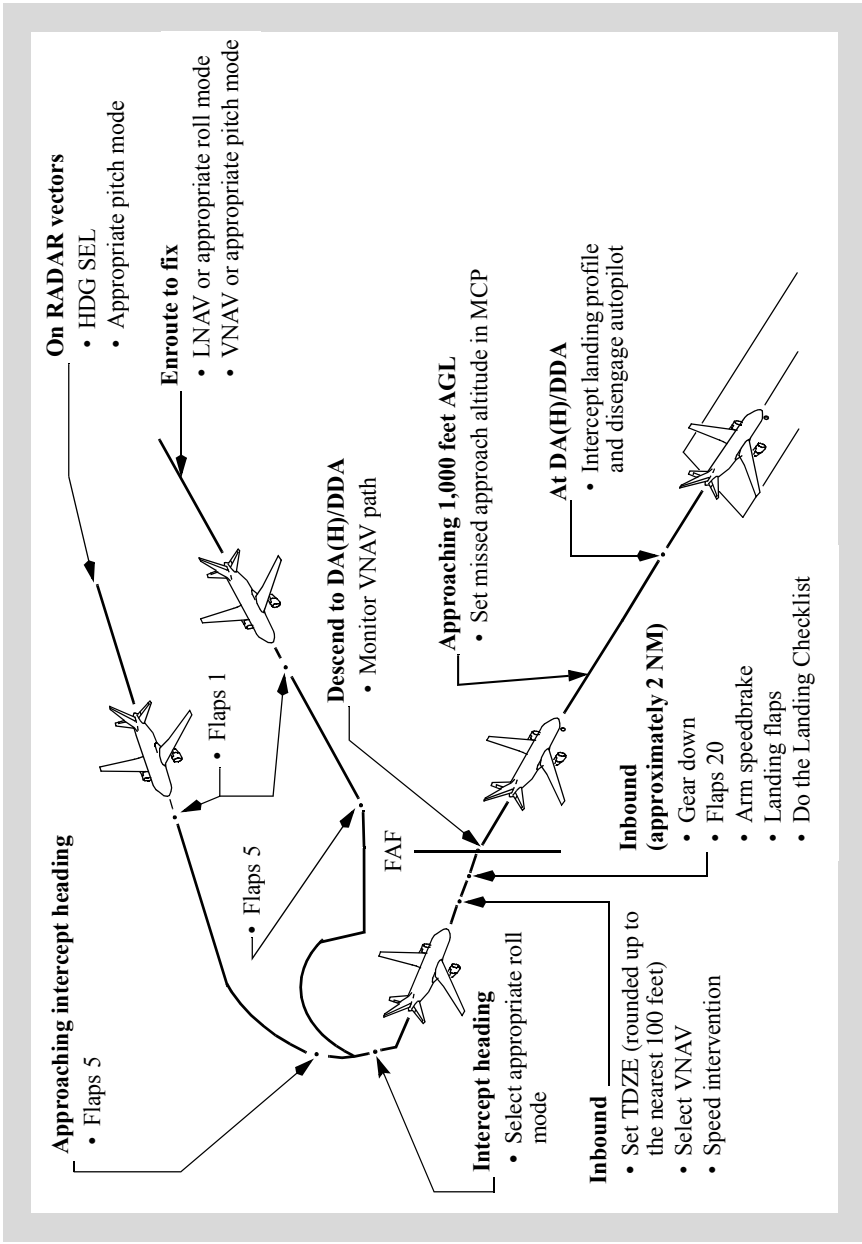
Copyright © The Boeing Company. See title page for details.

ILS Approach



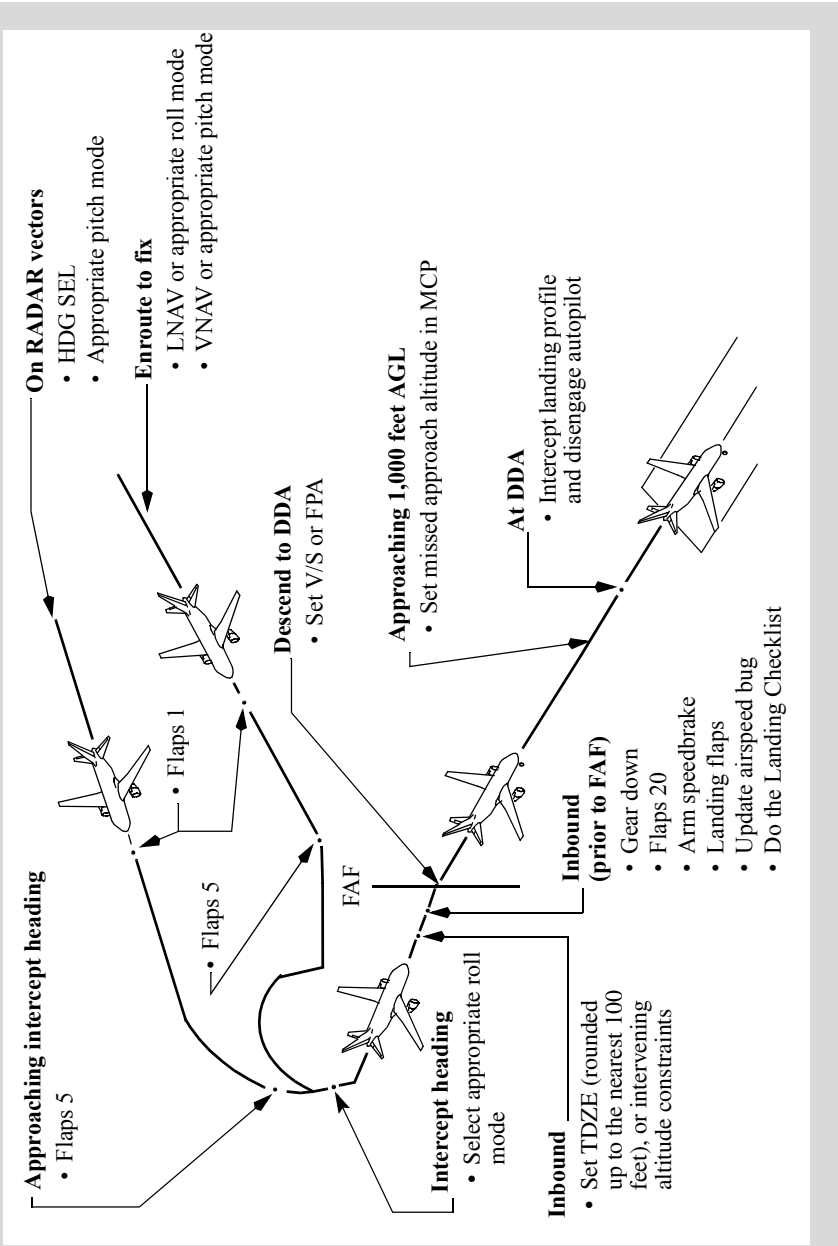
Copyright © The Boeing Company. See title page for details.

Instrument Approach Using VNAV



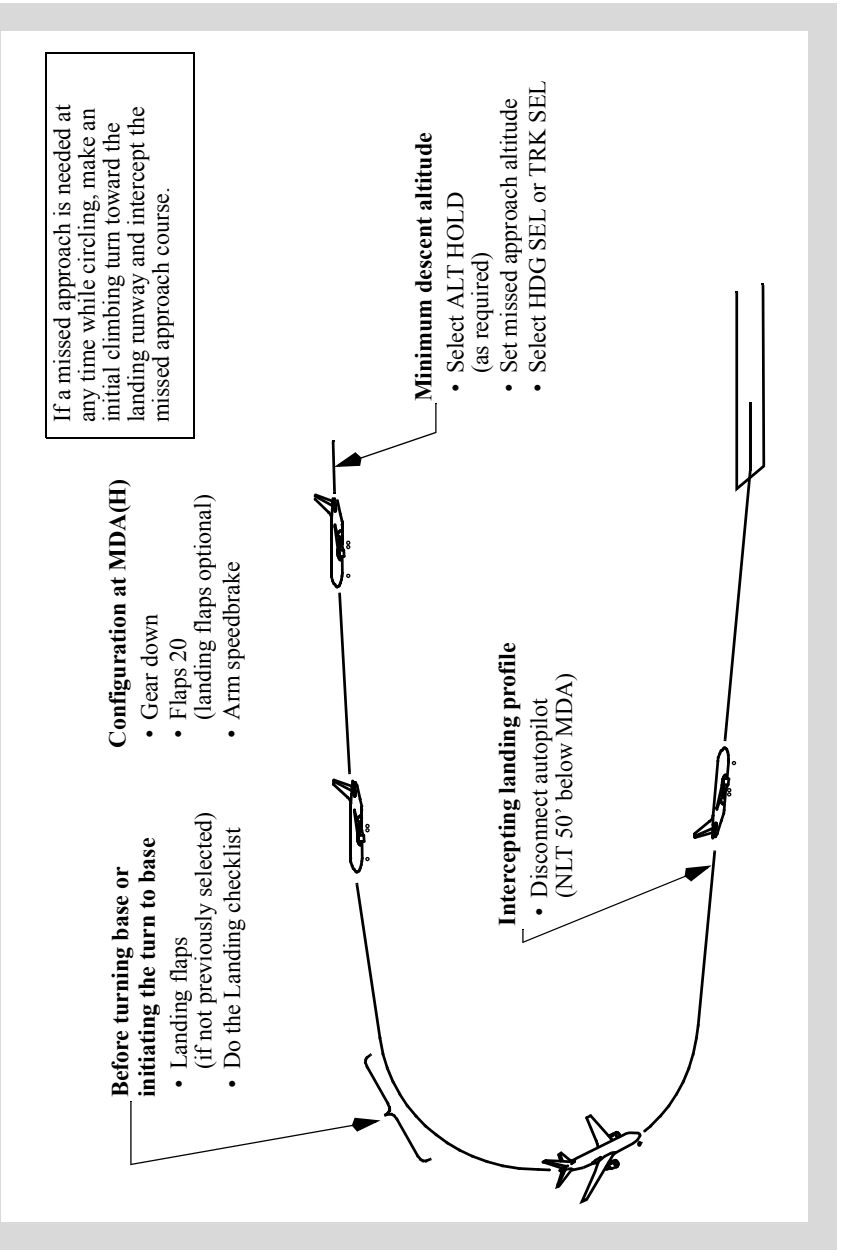
Copyright © The Boeing Company. See title page for details.

Instrument Approach Using V/S or FPA



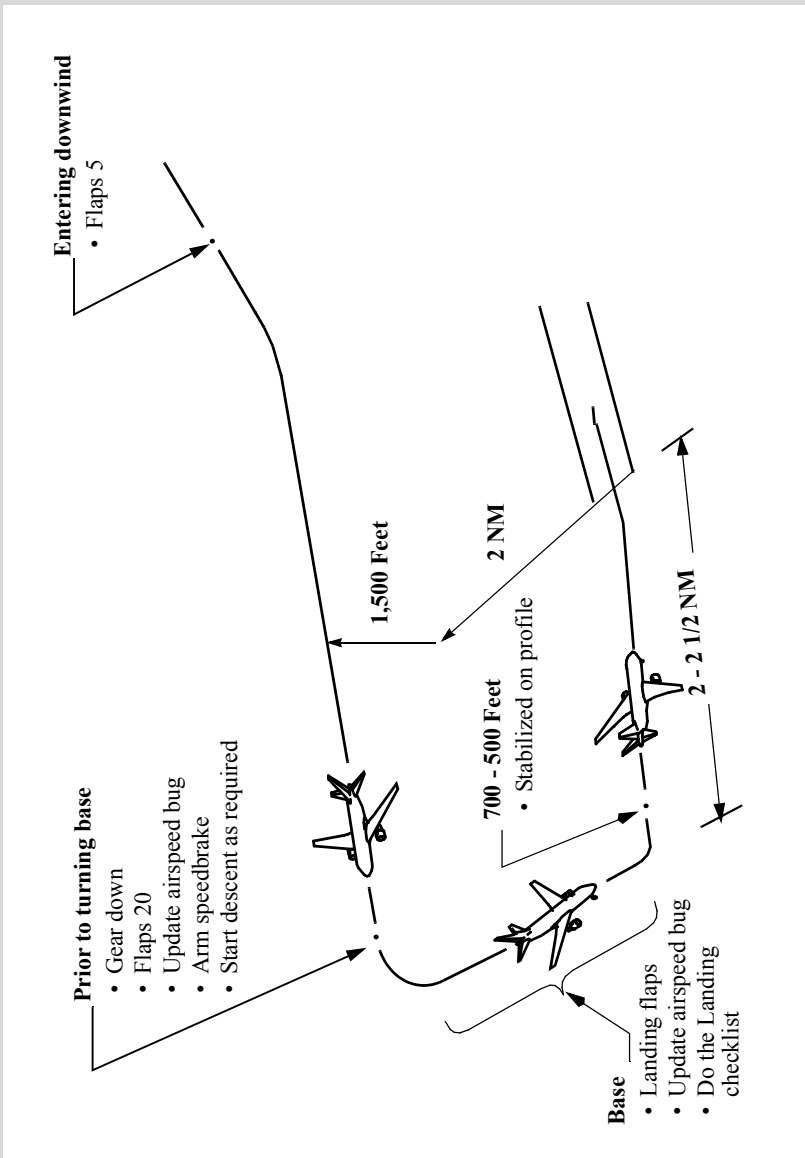
Copyright © The Boeing Company. See title page for details.

Circling Approach



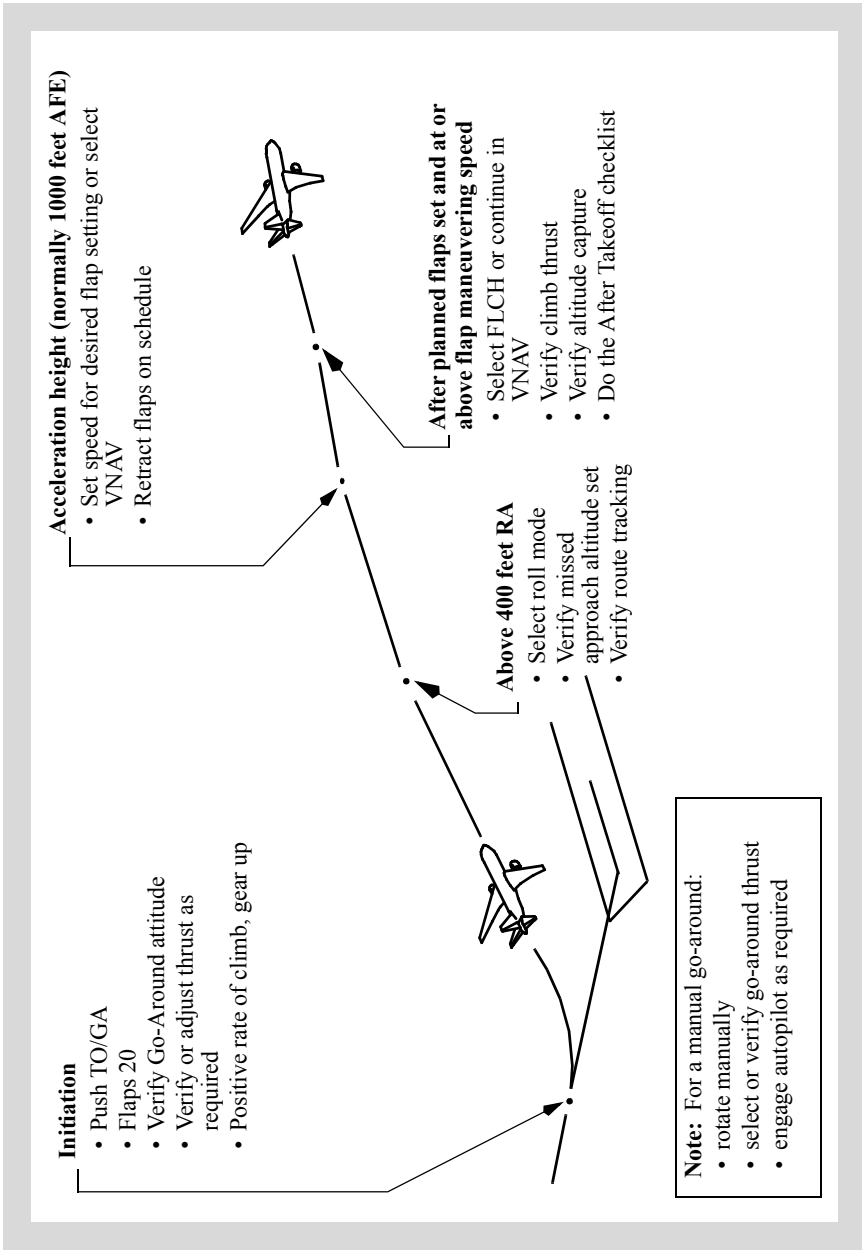
Copyright © The Boeing Company. See title page for details.

Visual Traffic Pattern



Copyright © The Boeing Company. See title page for details.

Go–Around and Missed Approach



Copyright © The Boeing Company. See title page for details.

Supplementary Procedures — Chapter SP
Table of Contents — Section 0

Intentionally
Blank

General

This chapter contains procedures (adverse weather operation, engine crossbleed start, and so on) that are accomplished as required rather than routinely performed on each flight. Systems tests are described in the System Description chapter of the applicable system.

Note: System tests are not normally a flight crew action.

Procedures accomplished in flight, or those that are an alternate means of accomplishing normal procedures (such as manual engine start), are usually accomplished by recall. Infrequently used procedures, not normally accomplished (such as engine crossbleed start) are usually accomplished by reference.

Supplementary procedures are provided by section. Section titles correspond to the respective chapter title for the system being addressed except for the Adverse Weather section.

Copyright © The Boeing Company. See title page for details.

Intentionally
Blank

Copyright © The Boeing Company. See title page for details.

Cabin Inspection

For a flight without a flight attendant staff (ferry flight, test flight, delivery flight, training flight, etc.) the pilots must secure the cabin.

- Doors - Secured and at least the 1L and 1R doors armed.
- Galley (coffee pots, doors, and drawers, etc.) - Secured.
- Beverage carts - Stowed and locked in position.
- Overhead bins - Closed.
- Closets - Closed and locked.
- Lavatories - Inspect for general security; doors locked.

After block-in, pilots should DISARM all doors and pass a thumbs up to the gate agent when the main entry door is ready to be opened.

Entry/Service Door Closing

Gust lock latch ..... Release

Door ..... Close

Manually position the door aft and inboard to cover the entry.

Door handle ..... Rotate

Rotate forward 180° to the closed position. The door lowers into position, latches, and locks.

Mode select lever ..... ARM

Observe yellow forward and aft girt bar flags are in view.

Entry/Service Door Opening

Mode select lever (interior only) ..... DISARM

Note: Escape slide/raft and powered door opening is disarmed automatically when the door is opened from outside.

Door handle ..... Rotate

Rotate aft 180° to the open position. The door is lifted clear of the pressure stops.

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Door .....Open

Manually position the door outboard and forward to open. The gust lock latch automatically engages and locks door in the open position.

Flight Deck Door Access System Test

Ships 7101 & Subsequent

INDICATOR LIGHTS TEST switch ..... Push and hold

Verify the AUTO UNLK and LOCK FAIL lights on door control panel illuminate.

INDICATOR LIGHTS TEST switch .....Release

Flight deck access system switch ..... NORM

Flight deck door .....Open

Flight deck door lock selector ..... AUTO

Emergency access code .....Enter

ENT key ..... Push

Verify alert sounds.

Verify AUTO UNLK light illuminates.

Flight deck door lock selector ..... DENY

Verify AUTO UNLK light extinguishes.

Flight deck door lock selector ..... UNLKD

Flight deck access system switch .....OFF

Verify LOCK FAIL light illuminates.

Flight deck access system switch ..... NORM

Guard - Down

Verify LOCK FAIL light extinguishes.

Copyright © The Boeing Company. See title page for details.

Flight Deck Door Access System Test

Ships 7001 – 7008

Flight deck access system switch ..... NORM

INDICATOR LIGHTS TEST switch ..... Push and hold

Verify the AUTO UNLK and LOCK FAIL lights on door control panel illuminate.

INDICATOR LIGHTS TEST switch ..... Release

Flight deck door ..... Open

Flight deck door lock selector ..... AUTO

Emergency access code ..... Enter

ENT key ..... Push

Verify alert sounds.

Verify amber keypad LED illuminates momentarily.

Verify AUTO UNLK light illuminates.

Flight deck door lock selector ..... UNLKD

Verify AUTO UNLK light extinguishes.

Verify green keypad LED illuminates.

Verify door lock solenoid disengages (audible click).

Note: The door lock solenoid will remain disengaged until the flight deck door lock selector is released.

Flight deck door lock selector ..... Release

Flight deck door lock catch mechanism ..... Push and hold

Depress and hold door lock catch mechanism, inside strike plate box on door jamb, to simulate a door closed condition.

Emergency access code ..... Enter

ENT key ..... Push

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Flight deck door lock selector ..... DENY

Verify red keypad LED illuminates for five seconds.

Verify door lock solenoid disengages (no audible click).

Verify AUTO UNLK light remains extinguished.

Verify no alert sounds.

Flight deck door lock selector .....Release

Flight deck door lock catch .....Release

The DENY mode will remain active until the door lock catch is released or the flight deck door lock selector is positioned to UNLK.

Flight deck access system switch .....OFF

Verify LOCK FAIL light illuminates.

Flight deck access system switch ..... NORM

Guard - Down

Verify LOCK FAIL light extinguishes.

Emergency Oxygen Use

Emergency oxygen should be used when necessary to provide positive pressure in the masks and goggles to prevent or evacuate contaminants. When positive pressure is not required, but contamination of flight deck air exists, 100% oxygen must be used. If prolonged use is required and the situation permits, oxygen availability should be extended by selecting normal flow. When oxygen use is no longer required, close the left hand oxygen compartment door to restore normal boom microphone operation.

Copyright © The Boeing Company. See title page for details.

Oxygen Mask Test

Full face oxygen mask ..... Stowed

Verify doors closed.

MFD STATUS page ..... Select

Note oxygen pressure (1,000 PSI minimum).

Regulator selector ..... EMER

Rotate the regulator selector to EMERGENCY position.

RESET/TEST switch ..... Push and hold

Verify the OXY ON indicator appears in switch.

Verify yellow cross appears continuously in the oxygen flow indicator.

Verify the crew oxygen pressure does not decrease more than 100 PSI.

Note: If the oxygen cylinder valve is not in the full open position, pressure may reduce rapidly, decrease more than 100 PSI, or slowly increase back to normal.

RESET/TEST switch ..... Release

Verify the OXY ON indicator no longer appears in switch.

Verify yellow cross does not appear in the oxygen flow indicator.

Verify the crew oxygen pressure returns to normal.

Regulator selector 100%

Rotate the regulator selector to 100% position.

Copyright © The Boeing Company. See title page for details.

Upper Crew Rest Compartments

Ships 7101 & Subsequent

Door 1 upper crew rest compartment may be occupied in all phases of flight with the following conditions:

- maximum occupancy during takeoff and landing is two
- maximum occupancy in remaining phases of flight is four.
- entrance door must be latched open for taxi, takeoff, climb, and landing

Door 4 upper crew rest compartment may be occupied above 25,000 feet with the following condition:

- maximum occupancy is six.

When occupying the Door 1 upper crew rest compartment:

SUPPLY AIRFLOW OFF light ..... Check

Verify SUPPLY AIRFLOW OFF light is extinguished.

If AIRFLOW OFF light is illuminated:

AIRFLOW/SMOKE RESET switch – Push and release

Push the AIRFLOW/SMOKE RESET switch one (1) time and wait ten minutes before closing compartment door.

If SUPPLY AIRFLOW OFF light remains illuminated:

Latch open compartment door to provide proper venilation.

When occupying the Door 4 upper crew rest compartment:

WARNING: The Door 4 upper crew rest area should not be occupied when the amber AIRFLOW OFF light is illuminated.

AIRFLOW OFF light ..... Check

Verify AIRFLOW OFF light is extinguished.

If AIRFLOW OFF light is illuminated:

AIRFLOW/SMOKE RESET switch – Push and release

Push the AIRFLOW/SMOKE RESET switch one (1) time and wait ten minutes before closing compartment door.

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

If AIRFLOW OFF light remains illuminated:

Do not occupy the crew rest compartment.

Upper Crew Rest Compartments

Ships 7001 – 7008

WARNING: The upper crew rest area should not be occupied when the amber AIRFLOW OFF light is illuminated.

Door 1 upper crew rest compartment may be occupied above 25,000 feet with the following condition:

- maximum occupancy is four.

Door 3 upper crew rest compartment may be occupied above 25,000 feet with the following condition:

- maximum occupancy is six.

Note: The upper crew rest compartments may not be occupied below 25,000 feet.

When occupying an upper crew rest compartment:

AIRFLOW OFF light ..... Check

Verify AIRFLOW OFF light is extinguished.

If AIRFLOW OFF light is illuminated:

AIRFLOW RESET switch – Push and hold

Hold switch for two seconds.

Note: The AIRFLOW RESET switch is inoperative when the airplane is below 25,000 feet.

AIRFLOW RESET – Release

If AIRFLOW OFF light remains illuminated:

Do not occupy the crew rest compartment.

Note: If a smoke test is initiated, or a smoke condition exists, partial aft galley power isolation will occur. Galley power can be restored by depressing the AIRFLOW RESET switch.

Copyright © The Boeing Company. See title page for details.

Intentionally
Blank

Copyright © The Boeing Company. See title page for details.

Air Conditioning Packs

Ground Air Conditioning Cart Use

Before connecting ground air conditioning cart:

PACK switches (both) – OFF

[Prevents pack operation if bleed air is supplied to airplane.]

RECIRCULATION FANS switches (both) – OFF

[Allows cart to operate at maximum efficiency.]

After disconnecting ground air conditioning cart:

PACK switches (both) – AUTO

RECIRCULATION FANS switches (both) – ON

Packs Off Takeoff

Before takeoff:

PACK switches (both) – OFF

Wait 30 seconds before setting takeoff thrust.

[Allows packs to shut down and EECs time to recompute maximum EPR/N1 line and reference/target EPR/N1 indications.]

After takeoff:

PACK switches (both) – AUTO

After engine thrust is reduced from takeoff to climb and prior to reaching 3000 feet above field elevation, position both pack switches to AUTO.

Copyright © The Boeing Company. See title page for details.

APU to Pack Takeoff

Ships 7101 & Subsequent

Before start:

PACK switches (both) – AUTO

On the THRUST LIMIT Page, select one of the following takeoff thrust ratings as directed by the WDR:

- full thrust
- percent derate
- takeoff bump

  Enter “APU” into the scratchpad and line select to the “SEL-APU” field. “APU” appears in small font representing the armed mode.

After engine start:

Leave APU running to supply air to the left pack.

Approximately one minute after second engine start, “APU” displays in large font representing the active mode.

Confirm proper configuration by noting a green “A-TO, A-TO 1, A-TO 2, or A-TO B on EICAS.

Note: If cabin temperature becomes excessive during extended ground operation, establish dual pack operation by deleting the APU selection. To re-establish APU to Pack operation, enter “APU” into the scratchpad and line select to the “SEL-APU” field.

Note: If an engine is shutdown after selecting APU to Pack operation, the engine cannot be started until APU to Pack takeoff mode has been deleted. To re-establish APU to Pack operation after start, re-enter "APU" into the scratchpad and line select to the "SEL-APU" field.

After climb thrust reduction:

APU Selector - Off.

Copyright © The Boeing Company. See title page for details.

Anti–Ice Operation

Requirements for use of anti-ice and operational procedures for engine and wing anti-ice are contained in Supplementary Procedures, Adverse Weather Section SP.16.

Windshield Wiper Use

CAUTION: Windshield scratching will occur if the windshield wipers are operated on a dry windshield.

Copyright © Delta Air Lines, Inc. See title page for details.

Intentionally
Blank

Copyright © Delta Air Lines, Inc. See title page for details.

AFDS

AFDS Operation

FLIGHT DIRECTOR switches .....ON
Verify FLT DIR is displayed in the AFDS system status annunciator.

If the autopilot is desired:

AUTOPILOT engage switch .....Push
Verify A/P is displayed in the AFDS system status annunciator.

Heading Hold

If the airplane is operating in polar regions:

HEADING REFERENCE switch ..... TRUE

HEADING/TRACK reference switch .....Push
Verify HDG is displayed in the HDG/TRK window.

Heading/track HOLD switch .....Push
Verify HDG HOLD is displayed in the roll mode annunciator.

Heading Select

Maintains the airplane heading the same as the selected heading.

If the airplane is operating in polar regions:

HEADING REFERENCE switch ..... TRUE

HEADING/TRACK reference switch .....Push
Verify HDG is displayed in the HDG/TRK window.

Heading/track SELECT switch.....Push
Verify HDG SEL is displayed in the roll mode annunciator.

Heading/track selector ..... Rotate
Set desired heading in the HDG/TRK window.

Copyright © The Boeing Company. See title page for details.

Track Hold

If the airplane is operating in polar regions:

HEADING REFERENCE switch ..... TRUE

HEADING/TRACK switch ..... Push
Verify TRK is displayed in the HDG/TRK window.

Heading/track HOLD switch ..... Push
Verify TRK HOLD is displayed in the roll mode annunciator.

Track Select

Maintains the airplane track the same as the selected track.

If the airplane is operating in polar regions:

HEADING REFERENCE switch ..... TRUE

HEADING/TRACK reference switch ..... Push
Verify TRK is displayed in the HDG/TRK window.

Heading/track SELECT switch ..... Push
Verify TRK SEL is displayed in the roll mode annunciator.

Heading/track selector ..... Rotate
Set desired track in the HDG/TRK window.

Altitude Hold

Altitude HOLD switch ..... Push
Verify ALT is displayed in the pitch mode annunciator.

Flight Level Change, Climb or Descent

ALTITUDE selector ..... Rotate
Set the desired altitude in the MCP ALTITUDE window.

FLCH switch ..... Push
Verify FLCH SPD is displayed in the pitch mode annunciator.

IAS/MACH selector ..... Rotate
Set the desired speed in the IAS/MACH window.

Copyright © The Boeing Company. See title page for details.

Vertical Speed, Climb or Descent

ALTITUDE selector ..... Rotate

Set the desired altitude in the MCP ALTITUDE window.

VERTICAL SPEED/FLIGHT PATH ANGLE reference switch..... Push

Verify V/S is displayed in the vertical speed/flight path angle window.

VERTICAL SPEED/FLIGHT PATH ANGLE switch ..... Push

Verify V/S is displayed in the pitch mode annunciator.

VERTICAL SPEED/FLIGHT PATH ANGLE selector ..... Rotate

Set the desired vertical speed in the VERTICAL SPEED/FLIGHT PATH ANGLE window.

If a climb is desired:

Select climb thrust limit on the CDU THRUST LIM page.

Flight Path Angle, Climb or Descent

ALTITUDE selector ..... Rotate

Set the desired altitude in the MCP ALTITUDE window.

VERTICAL SPEED/FLIGHT PATH ANGLE Reference switch .... Push

Verify FPA is displayed in the vertical speed/flight path angle window.

VERTICAL SPEED/FLIGHT PATH ANGLE switch ..... Push

Verify FPA is displayed in the pitch mode annunciator.

VERTICAL SPEED/FLIGHT PATH ANGLE selector ..... Rotate

Set the desired flight path angle in the VERTICAL SPEED/FLIGHT PATH ANGLE window.

If a climb is desired:

Select climb thrust limit on the CDU THRUST LIM page.

Copyright © The Boeing Company. See title page for details.

Autothrottle Operation

AUTOTHROTTLE ARM switches ..... ARM

If the pitch mode is TO/GA:

TO/GA switch ..... Push

Verify that THR REF is displayed in the autothrottle mode annunciator. THR REF changes to HOLD at 80 knots.

If the pitch mode is ALT, V/S, FPA, G/S, or no pitch mode:

AUTOTHROTTLE switch ..... Push

Verify that SPD is displayed in the autothrottle mode annunciator.

If a constant speed is desired:

IAS/MACH selector ..... Rotate

Set the desired speed in the IAS/MACH window.

If climb or continuous thrust is desired:

CLB CON switch ..... Push

Verify that THR REF is displayed in the autothrottle mode annunciator.

If FLCH or VNAV is desired:

FLCH or VNAV switch ..... Push

Verify that THR REF, THR, SPD, IDLE, or HOLD as appropriate is displayed in the autothrottle mode annunciator.

If TO/GA is desired:

TO/GA switch ..... Push

The pitch mode will change to TO/GA. Verify that THR or THR REF is displayed in the autothrottle mode annunciator.

If the pitch mode is VNAV PTH, VNAV ALT, VNAV SPD, or FLCH SPD:

AUTOTHROTTLE switch ..... Push

Verify THR REF, THR, SPD, IDLE, or HOLD as appropriate is displayed in the autothrottle mode annunciator.

Copyright © The Boeing Company. See title page for details.

Non-ILS Instrument Approach

Special Aircraft and Aircrew Authorization Required (SAAAR) for RNAV (RNP) approaches.

777 RNAV (RNP) approaches are not permitted without Ops Specs authorization published in Airway Manual.

For inoperative equipment, refer to the RNAV Approach Equipment Requirements List in the Normal Procedures Introduction section, when flying an RNAV (RNP) or RNAV (GPS) approach.

Approach Preparation

FMC approach procedure ..... Select/Verify

Compare the FMC approach waypoints and altitude constraints using the approach chart and resolve any discrepancies.

Note: Do not manually build the approach or add/modify waypoints of the selected FMC procedure.

Note: If airport temperature is -10°C, or lower, complete the Cold Weather Temperature Altitude Correction procedure in Airway Manual chapter, Chapter 4.

RNP ..... Enter/Verify

For RNAV (RNP) approaches:

Enter published RNP value from the approach plate.

Note: The 777 is not authorized for RNAV (RNP) approaches with a published RNP less than 0.11.

For all other non-ILS approaches:

Verify displayed RNP is 0.3.

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

BARO approach minimums ..... Set

Note: In order to use VNAV, a glide path (GP) must be depicted on the FMC LEGS page. RNAV (GPS) RNAV (RNP) require VNAV. LNAV ONLY minimums are not authorized.

When using VNAV as the pitch mode:

RNAV (RNP), RNAV (GPS) – Set published DA.

Note: Use Category D minimums if the approach or missed approach includes an RF leg.

ILS GS OUT – Set published MDA as DA.

Approach with ball note authorizing VNAV (DA) – Set published MDA as DA.

Approach without ball note authorizing VNAV (DA) – Set a Derived Decision Altitude (DDA)
(MDA + 50 feet).

When using V/S or FPA as the pitch mode:

Set a DDA (MDA + 50 feet).

GPS receivers [RNAV (RNP)] ..... Verify

Verify two GPS receivers are operative on FMC POSITION page three.

VOR/DME updating [RNAV (RNP)] ..... Inhibit

Inhibit VOR/DME updating on the FMC NAV DATA page.

Altimeters [RNAV (RNP)] ..... Set

Ensure the current local altimeter setting is set in both altimeters, and agree within +/- 75 feet, prior to the FAF.

Note: The 777 has an uncompensated Baro-VNAV system.

Navigation Displays [RNAV (RNP)/(GPS)] .....Check

Verify “GPS” is displayed on NDs.

Copyright © The Boeing Company. See title page for details.

When Cleared for the Approach

AFDS roll mode ..... Select/Verify

Recommended roll modes:
- ILS GS OUT or LOC approaches – LOC.
- All others – LNAV.

Verify appropriate roll mode annunciates.

When Established on a Published Segment of the Approach

An aircraft is considered established on a published segment of the approach when:
- RNAV: XTK error is less than entered RNP value.
- LOC: Less than 1 dot.
- VOR and NDB: Within 5 degrees of course.

If using VNAV as pitch mode:

MCP altitude ..... Set TDZE

If TDZE is not an even 100 feet increment, set MCP altitude to next 100 feet increment above the TDZE.

VNAV ..... Select

Speed intervention ..... Set

Set desired airspeed.

FMA pitch mode ..... Check

Ensure VNAV PATH is the FMA pitch mode prior to continuing past the FAF.

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Use of the acronym “LAVS” may help crews to remember the above procedures:

- L - LNAV/LOC
- A - Altitude
- V - VNAV
- S - Speed intervention.

If using V/S or FPA as the pitch mode:

When level at FAF altitude:

MCP altitude ..... Set TDZE

If TDZE is not an even 100 feet increment, set MCP altitude to next 100 feet increment above the TDZE.

At the FAF:

V/S or FPA ..... Select

Descent rate/angle ..... Set

Set appropriate descent rate or angle.

During the Approach

CDUs ..... Set

The PF should have the FMC LEGS page displayed.

The PM should monitor XTK and VTK error on FMC PROGRESS page four.

EFIS TERRAIN switch (if applicable) ..... Push

Raw data (if applicable) ..... Monitor

When inside the FAF, final descent path is established, and at least 300 feet below the missed approach altitude:

Missed approach altitude ..... Set

Copyright © The Boeing Company. See title page for details.

For RNAV (RNP) Approaches:

Autopilot ..... Engaged

The autopilot must be used when in IMC or whenever a segment of the approach features an RF leg.

Navigation Displays ..... Check/Monitor

Verify "GPS" is displayed on NDs and monitor throughout approach.

Missed Approach

Execute a missed approach for the following:

For all approaches:
- Runway environment is not in sight upon reaching minimums
- XTK error exceeds RNP value.

If using VNAV as pitch mode :
- VNAV PATH is lost
- VTK error exceeds 75 feet.

For RNAV (RNP) and RNAV (GPS) approaches:
- NAV UNABLE RNP caution message is displayed
- "GPS" is no longer displayed on NDs.

RNAV (RNP) Missed Approach

If missed approach is initiated between IAF and FAF:

Above missed approach altitude:

ALTITUDE HOLD ..... Push

Below missed approach altitude:

Missed approach altitude ..... Verify

Confirm misssed approach altitude is set in the MCP window.

Climb ..... Initiate

Initiate climb by pushing TOGA, FLCH, or VS as desired.

LNAV ..... Verify engaged

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Autopilot ..... Verify engaged

Maintain published approach track until further clearance is received.

Note: If unable to contact ATC for instructions, fly the approach track to a point where a transition can be made to the published missed approach procedure.

If missed approach is initiated after the FAF:

TOGA ..... Push

LNAV ..... Verify engaged

Autopilot ..... Verify engaged

Maintain published approach track until further clearance is received.

Note: If unable to contact ATC for instructions, fly the approach track to a point where a transition can be made to the published missed approach procedure.

Landing:

A/P DISENGAGE switch (if autopilot is in use) ..... Push

Disengage autopilot before descending below DA/DDA minus 50 feet.

Copyright © The Boeing Company. See title page for details.

Circling Approach

Note: Autopilot use is recommended until intercepting the landing profile.

MCP Altitude selector ..... Set MDA

Accomplish an instrument approach, establish suitable visual reference, and level off at MDA(H).

Verify ALT or VNAV ALT mode annunciates.

MCP Altitude selector ..... Set Missed Approach Altitude

HDG SEL/TRK SEL switch ..... Push

Verify HDG SEL or TRK SEL mode annunciates.

Intercepting the landing profile:

Autopilot disengage switch ..... Push

PAR Approach

Note: Autopilot use is recommended until suitable visual reference is established.

Recommended pitch mode: V/S (use FPA as required).

Recommended roll mode: HDG SEL.

Controller will provide course guidance and glidepath information. Controller will frequently inform the aircraft of any deviation from glidepath or course. Transmissions with aircraft on precision final approach should occur approximately every 5 seconds. Controller will provide DH to any pilot who requests it. The Controller will also advise when the aircraft reaches the point where final descent is to start and when the aircraft reaches the published decision height. The final controller will provide final landing clearance.

Prior to intercepting final approach course:

If a runway or an approach is available in FMS, consider its use for situational awareness.

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

Prior to descent to the Decision Height:

MCP altitude .....Set TDZE (rounded up to nearest 100 feet)

Using V/S or FPA:

Approaching glidepath (per Controller transmission):

V/S or FPA switch – Push

Verify the pitch flight mode annunciation indicates the selected mode.

Desired V/S or FPA – Set

Set desired V/S or FPA to approximate glidepath to descend to DH. Expect to update frequently in incremental amounts based on Controller's glidepath deviation transmissions (i.e., "Above or Below Glidepath").

When the airplane is at least 300 feet below Missed Approach Altitude and NLT 1,000 feet AGL:

MCP altitude .....Set Missed Approach Altitude

At DH:

If suitable visual reference is not established, execute missed approach.

After suitable visual reference is established:

A/P Disengage switch ..... Push

Disengage autopilot before descending below DH and no lower than 200 feet AGL.

Copyright © The Boeing Company. See title page for details.

Flight Deck Communications System (Datalink)

The following procedures are one means which may be used to verify Pre-Departure Clearance, Digital-Automatic Terminal Information Service, Oceanic Clearances, Weight and Balance and Takeoff Data messages transmitted via the COMPANY format.

Pre-Departure Clearance

The flight crew shall manually verify (compare) the filed flight plan versus the digital pre-departure clearance and shall initiate voice contact with Air Traffic Control if any question/confusion exists between the filed flight plan and the digital pre-departure clearance.

Digital-Automatic Terminal Information Service

The flight crew shall verify that the D-ATIS altimeter setting numeric value and alpha value are identical. If the D-ATIS altimeter setting numeric value and alpha value are different, the flight crew must not accept the D-ATIS altimeter setting.

Oceanic Clearances

The flight crew shall manually verify (compare) the filed flight plan versus the digital oceanic clearance and initiate voice contact with Air Traffic Control if any questions/confusion exists between the filed flight plan and the digital oceanic clearance.

Weight and Balance

The flight crew shall verify that the Weight and Balance numeric and alphabetic values are identical. If the Weight and Balance numeric and alphabetic values are different, the flight crew must not accept the Weight and Balance data.

Takeoff Data

The flight crew shall verify that the Takeoff Data numeric and alphabetic values are identical. If the Takeoff Data numeric and alphabetic values are different, the flight crew must not accept the Takeoff Data message.

Copyright © The Boeing Company. See title page for details.

AWABS Update

Pilot requests for changes to the Weight Data Record (WDR) are made using the AWABS request page.

Rather than uplinking an entire WDR which would require many uplink blocks, the Remote Command Processor (RCP) extracts pertinent information from the resulting WDR and uplinks only this information.

The system may be used between OUT and OFF times. Requests made prior to receipt of the OUT message are rejected because there may not be complete passenger, cargo and/or fuel data in AWABS yet. Requests after the OFF message is received are rejected because AWABS closes the flight automatically after takeoff. The system is available world-wide subject to ACARS communication availability.

Because the RCP depends upon flight identification data in the header of every downlink message, please assure that ACARS is properly initialized.

AWABS Update Request

To perform an AWABS update:

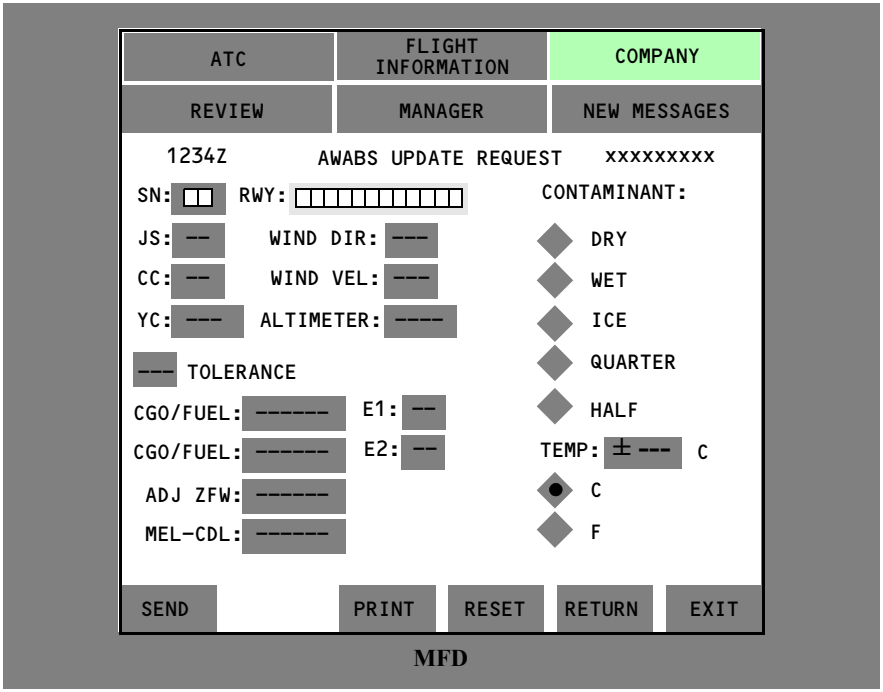
COMM page ..... Select

COMPANY menu ..... Select

AWABS UPDATE ..... Select

Selection displays the AWABS UPDATE REQUEST page.

Copyright © The Boeing Company. See title page for details.



MFD

AWABS UPDATE REQUEST data ..... Enter

Enter information into the appropriate fields.

Note: The AWABS request message consists of several fields. The first three fields are mandatory and the remaining fields are optional.

SEQUENCE NUMBER (required) – Enter

This field will be used in the future.Any number will satisfy ACARS requirements and will be ignored by the ground processor.

RUNWAY IDENTIFIER (required) – Enter

Enter the desired takeoff runway. AWABS data will only be sent for this runway. This identifier must be recognizable by AWABS (consult the existing WDR for the exact label).

Examples include:

Continued on next page

Copyright © The Boeing Company. See title page for details.

Continued from previous page

- 26R - Runway 26 Right
- 26LTWYE13 - Runway 26 Left at taxiway E 13
- 25LPOSNF - Runway 25 Left at takeoff position NF (this is an FRA runway.)
- For a list of possible runway labels enter either an impossible or non-existent runway (e.g., 99). This list will indicate the possible runways and a one- or two-character identifier. The system keeps track of the uplinked runway list, and subsequent requests may utilize either the full identifier or the one- or two-character identifier.

Note: Do not use a slash character within the runway identifier field.

CONTAMINANT TYPE (required) – Enter

Selections are DRY, WET, ICE, QUARTER, and HALF. When within weight tolerance for the requested contaminant, an Uplink WDR will be sent which will contain data for all available contaminant types

If overgross for the requested contaminant, an error response will be sent and no WDR will be received.

The remaining fields on the AWABS page are optional and are used only when a change from the existing WDR is desired.

TEMP (optional) – Enter

Current temperature in degrees Fahrenheit (default) or Celsius (C).

WIND DIR/VEL (optional) – Enter

ALTIMETER (optional) – Enter

The altimeter setting is specified without the decimal point. For example, 30.06 would be reported 3006. Metric or US standard are permitted. Entries between 915 and 1083 are assumed to be millibars; entries between 2700 and 3200 are assumed to be inHg.

Copyright © The Boeing Company. See title page for details.

FC/CC/YC (optional) – Enter

Passenger count. Enter data only in the classes you wish to change. The 777 is currently configured as a two-class airplane (C and Y). If a class remains unchanged, leave the place blank.

Examples: To change C class passengers to 20, enter “20”; to change Y class passengers to 118, enter “118”.

Note: When passenger counts are not entered the system displays the most current passenger and cargo information available in AWABS. This assures that in the event a payload correction has been made in AWABS you will receive the most current data.

TOLERANCE (optional) – Enter

Can be set to one of two choices:

- --- = OFF - selects tolerance off. This will reduce the A/C weight by 2000 pounds if tolerance was previously ON.
- Check mark = ON - selects tolerance on. This will provide the ‘add on’ capability for 8 passengers and/or 520 pounds of cargo and increase the A/C weight by 2000 pounds.

Note: The RCP will remove tolerance automatically if necessary to accommodate balance and/or performance requirements. In this event a crew advisory will be included at the top of the Uplink WDR.

Other fields are not in use at this time.

Copyright © The Boeing Company. See title page for details.

Cabin Medical Communication

Ships 7101 & Subsequent

At the captain's discretion, this procedure may be used during a medical emergency to allow direct communication between the cabin and a ground based medical consultant (currently UPMC).

Note: Audio jacks are installed above center seat rows 3, 12, 33, 40, 47 and 55, and the cabin is equipped with a headset.

When cabin medical communication is required:

Medical consultant communications ..... Establish

First observer's audio panel ..... Set

Configure speaker and microphone select buttons.

Cabin communications ..... Initiate

Inform cabin crew that communication with the medical consultant has been established and is available for their use.

If possible, monitor the cabin/medical communication through first observer's audio control panel.

When cabin medical communication is no longer required:

First observer's audio panel ..... Reset

Reconfigure first observer's audio control panel and instruct Flight Attendants to stow headset.

Note: Under no circumstances should a passenger be allowed to plug a personal headset into a cabin medical communications audio jack.

Copyright © The Boeing Company. See title page for details.

Cockpit Voice Recorder Test

TEST switch ..... Push and hold

Push and hold the TEST button for 5 seconds.

Ships 7101 & Subsequent
Verify status indicator light illuminates.

Ships 7001 – 7008
Observe the indicator pointer in the green band.

Note: If indicator fails to remain in the green band, plug headset into recorder jack. A tone should be heard for each channel during test.

TEST switch ..... Release

Inadvertent ADS Emergency Activation

If ADS EMERGENCY is noted by ATC, with the absence of follow-up emergency measures (communication or divergence from track/altitude), ATC will call with a “CONFIRM ADS” request.

- If ADS EMERGENCY ON was inadvertently selected:
  - Respond immediately with “ADS RESET”, then select ADS EMERGENCY OFF under DSP COMM \ MANAGER \ ADS.
- If ADS EMERGENCY ON was intentionally selected:
  - If able, respond immediately with flight status and intentions.
  - If clarification/communication is not possible, continue with ADS EMERGENCY ON selected.

Copyright © The Boeing Company. See title page for details.

Controller Pilot Data Link Communication (CPDLC) and Automatic Dependent Surveillance (ADS)

For ADS and CPDLC operations, theater differnces, logon codes, and phraseology refer to the Airway Manual chapter 6 (Communications).

CPDLC Procedures

Refer to Operations Manual, Volume 2, Communications section, for explanation of individual CPDLC functions.

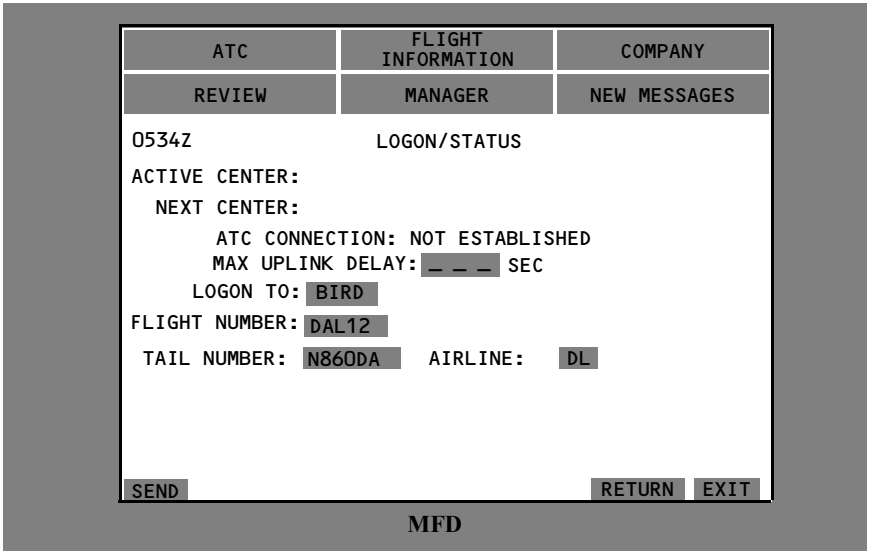
CPDLC Preflight / Logon

DSP COMM Switch ..... Select

ATC ..... Select

LOGON/STATUS ..... Select

Displays the LOGON/STATUS page.



MFD

Ensure the following are filled in properly:

LOGON TO ..... _ _ _ _

Type in appropriate FIR identifier.

Copyright © The Boeing Company. See title page for details.

FLIGHT NUMBER ..... DAL _ _ _ _

After route activated ensure proper format (e.g., DAL12)

Note: Do not put zero as first digit (e.g., DAL12, not DAL012)

TAIL NUMBER .....N _ _ _ _ _

Verify FAA registration number is properly filled in.

AIRLINE ..... DL

Verify "DL" is filled in.

Note: If ADS is available, the ADS logon will occur automatically within a few seconds. See ADS section below and follow ADS Logon verification procedure whenever you send a LOGON.

Note: While the logon is accomplished on the same page, ADS and CPDLC are two separate and unrelated connections.

SEND .....Select

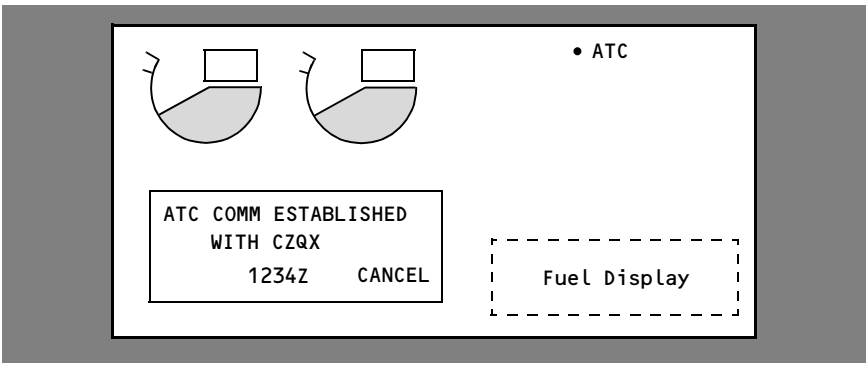
Refer to Airway Manual chapter 6 (Communications) for information regarding when to send logon.

After selecting SEND, the controlling ATC facility will reply to the LOGON downlink when the aircraft is within the the facility's LOGON parameters. An uplink will then be sent to confirm the CPDLC connection.

Logon Verification for CPDLC

Logon is confirmed when "ATC COMM ESTABLISHED WITH ____" appears in ATC Uplink Message Block on upper EICAS display.

When controlling ATC facility disconnects CPDLC, or CPDLC connection is lost, "ATC DATALINK LOST" EICAS message displays.



Copyright © The Boeing Company. See title page for details.

Downlinks

Selecting "ATC" from the COMM menu page accesses CPDLC downlink message pages. Refer to Operations Manual, Vol. II, Communications section for explanation of individual downlink pages.

ATC Uplinks

Most ATC clearances will display automatically on the upper EICAS in the ATC Uplink Message Block accompanied by an aural chime. All ATC uplinks can be viewed on the Lower MFD by selecting "COMM" on the DSP. If "LARGE ATC UPLINK" is displayed in Uplink Message Block, the clearance is too large to display on the Upper EICAS and must be viewed on the Lower MFD. For most ATC uplinks requiring crew response, "ACCEPT, REJECT or CANCEL" can be selected using the switches on the glareshield, or by using command keys located at the bottom of the communication page on the Lower MFD. Traditional PF/PM communication and flying duties will apply to all CPDLC clearances.

ATC Requested Reports

Some ATC clearances contain requirements for future reports (e.g., "report level"). Some ATC reports may be armed for automatic transmission at the appropriate time.

After airplane systems configured and uplink response sent:

ATC menu ..... Select

ATC REQUESTED REPORTS ..... Select

Select the appropriate report.

ARM ..... Select

When report condition is satisfied, the downlink report sends automatically. A message verifying the report was sent will display in the ATC Uplink Message Block.

Copyright © The Boeing Company. See title page for details.

ADS Procedures

ADS Preflight

Note: There are no preflight requirements for ADS.

ADS Logon

Ensure the following are filled in properly:

LOGON TO ..... _ _ _ _

Type in appropriate FIR identifier.

FLIGHT NUMBER ..... DAL _ _ _ _

After route activated ensure proper format (e.g., DAL12)

Note: Do not put zero as first digit (e.g., DAL12, not DAL012)

TAIL NUMBER ..... N _ _ _ _ _

Verify FAA registration number is properly filled in.

AIRLINE ..... DL

Verify "DL" is filled in.

Note: If ADS is available, the ADS logon will occur automatically within a few seconds. See ADS section below and follow ADS Logon verification procedure whenever you send a LOGON.

Note: While the logon is accomplished on the same page, ADS and CPDLC are two separate and unrelated connections.

ADS Logon Verification

DSP COMM switch ..... Select

MANAGER ..... Select

ADS ..... Select

The logon is confirmed when "XXXXZ - ADS CONNECTION ESTABLISHED - XXXXXXX" is displayed.

Note: There can be as many as 5 separate ADS connections established. Connections will be made and lost as required by the individual facilities. Since the ADS status is not readily evident, flight crews must accomplish the above procedure to confirm ADS connections at LOGON and whenever in doubt.

Copyright © The Boeing Company. See title page for details.

ADS Disconnect and Verification

When no longer needed ATC should disconnect ADS. However, some ADS facilities may not disconnect and SATCOM datalink charges will accrue as long as an ADS connection is active.

When Radar Contact is established and/or ADS is no longer required, crews should disconnect ADS and verify.

Copyright © The Boeing Company. See title page for details.

Delay Codes

When entering Delay and Service Failure codes, use the Free Text page on the COMM menu.

Enter the following information:

- "ATLWDDL" in address box
- primary code for delay followed by any secondary codes.

Note: Reports may be combined; e.g., Pushback Delay, Departure Delay.

Note: Send the reports when crew workload permits and safety is not compromised.

Use the codes on the following pages for each report:

Pushback Delays

Report any pushback delay that exceeds D-0.

If a delay or service failure occurs up to dispatch agent salute:

Code	Reason
PBRD	Boarding not complete/paperwork not available
PCAB	Cabin not ready for pushback/passenger issue
PATC	ATC wheels up time
PPSH	Pushback clearance not available/ramp blocked
PFUL	Fueling not completed/late completion
PCAT	Catering not completed/late completion
PCLN	Cabin cleaning not completed/late completion
PCRW	Flight crew (Pilot or FA) late to aircraft (less than 30 minutes prior to departure)
PEQP	Late arriving equipment to gate
PCGO	Ground crew servicing (e.g., loading cargo, water servicing, late bags, etc.)
PMTC	Maintenance issue
PLAV	Lavatory service not completed/late completion
PSEC	Security issues

Copyright © The Boeing Company. See title page for details.

Departure Delays

Report any departure delay that exceeds planned taxi time by 15 minutes or more.

If a delay occurs after dispatch agent salute and prior to takeoff:

Code	Reason
DATC	ATC flow control issues/runway change
DWAY	Airport/taxiway congested
DRMP	Ramp congested
DWDR	AWABS update/closeout required
DICE	De/Anti-icing delay
DMTC	Maintenance issue which delayed takeoff

Service Failure During Flight

If a service failure is reported during the flight or the service failure was accepted prior to pushback:

- A flight attendant will contact the cockpit and provide a list of services that were not available.

Code	Reason
SICE	Ice or beverages serviced to min specs
SWTR	Aircraft not serviced with potable water
SBEE	Aircraft had "B spec" cleaning to expedite on-time departure
SLAV	Lavatories poorly cleaned/strong odor present
SBKT	Aircraft not stocked with adequate blankets
SGAL	Aircraft missing galley equipment
SCAT	Flight not fully catered
SPAX	Failed to load pax/non-revs with seats available.

Copyright © The Boeing Company. See title page for details.

Arrival Delays

If a delay occurs upon arrival at the gate:

Code	Reason
AANA	Gate agent not available
AGNA	Gate not available (e.g., departing aircraft still in the gate)
AGAT	Gate change after landing
AJNP	Jetway not pre-positioned
ALNO	Parking light not on
ANGC	No ground crew/ground crew not prepared
AOBS	Obstructions within safety lines
ARMP	Ramp congestion

Copyright © The Boeing Company. See title page for details.

FIRM Code Downlinks Via ACARS

Note: If a maintenance irregularity is discovered prior to pushback, a phone call to the TMC is preferable to an ACARS downlink.

To send a FIRM code via ACARS:

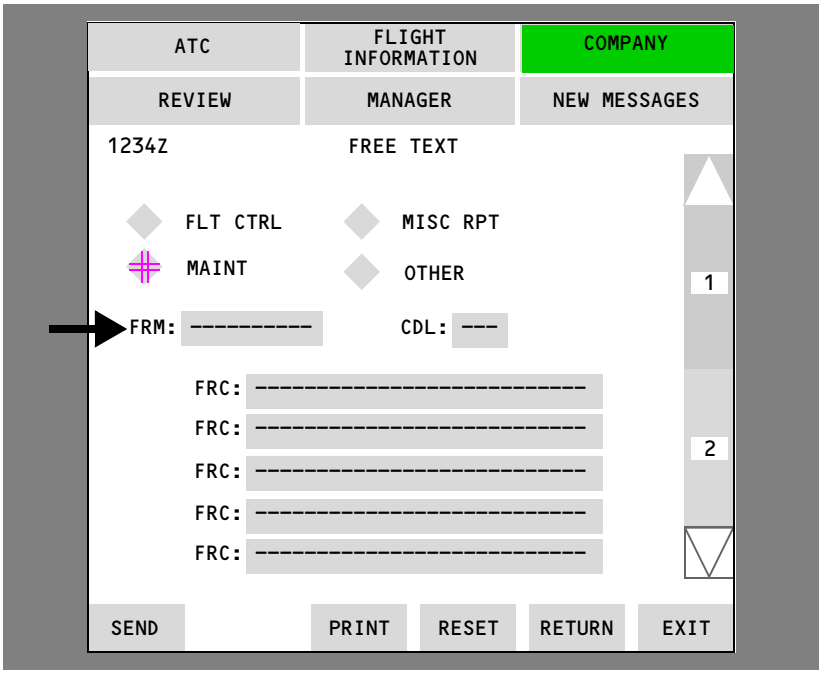
MTC REPORT page ..... Select

COMM ..... Select

FREE TEXT ..... Select

MAINT ..... Select

Enter the FRM code number on the FRM line. Do not include spaces from the FRM code. Example: 33163247.



SEND ..... Select

Note: The FRM code should be entered in the FRM code block of the aircraft logbook. Also, a brief description of the maintenance irregularity should be entered in the Irreg. block of the aircraft logbook.

Copyright © The Boeing Company. See title page for details.

After shutdown:

If arrival is at a maintenance station, no further action is required.

If arrival is at a non-maintenance station, contact the TMC via telephone.

Copyright © The Boeing Company. See title page for details.

Intentionally
Blank

Copyright © The Boeing Company. See title page for details.

Electrical Power Down

The following procedure is accomplished to remove all electrical power from the airplane.

Before accomplishing the following steps, verify ADIRU, EMER LIGHTS, and PACK switches are off and HYD PRESS SYS L+C+R message is displayed.

APU selector and/or EXTERNAL POWER switch(es) ..... OFF

BATTERY switch ..... OFF

Copyright © The Boeing Company. See title page for details.

Electrical Power Up

The following procedure is accomplished to permit safe application of electrical power.

BATTERY switch ..... ON

C1 and C2 PRIMARY pump switches ..... OFF

DEMAND pump selectors ..... OFF

WIPER selectors ..... OFF

Landing gear lever ..... DN

ALTERNATE FLAPS selector ..... OFF

Electrical power ..... Establish

BUS TIE switches – AUTO

If external power is desired:

PRIMARY EXTERNAL POWER AVAIL light – Illuminated

PRIMARY EXTERNAL POWER switch – Push

If the SECONDARY EXTERNAL POWER AVAIL light is illuminated:

SECONDARY EXTERNAL POWER switch – Push

If APU power is desired:

APU GENERATOR switch – ON

APU selector – START, then ON

Copyright © The Boeing Company. See title page for details.

APU Ground Pneumatic Start

Duct pressure ..... Observe

Observe duct pressure is a minimum of 15 PSI (less 1 PSI per 1000 feet of pressure altitude).

Accomplish normal APU start.

Engine Battery Start

Accomplish the normal Exterior Inspection and the normal Preliminary Preflight Procedure – Captain or First Officer through "Circuit breakers.....Check."

BATTERY switch ..... ON

C1 and C2 PRIMARY pump switches ..... OFF

DEMAND pump selectors ..... OFF

WIPER selectors ..... OFF

Landing gear lever ..... DN

ALTERNATE FLAPS selector ..... OFF

STANDBY POWER switch
(overhead maintenance panel) ..... Push to BAT, release to AUTO

Center bleed ISOLATION switch ..... OFF

Ground pneumatic source (if available) ..... Connect

If the APU is required for pneumatic power:

APU selector ..... START, then ON

Speedbrake lever ..... Down

Reverse thrust levers ..... Down

Thrust levers ..... Closed

Flap position indication and flap lever ..... Agree

Parking brake ..... Set

Copyright © The Boeing Company. See title page for details.

FUEL CONTROL switches ..... CUTOFF

Captain's audio control panel ..... Set

Start the left engine using the normal Engine Start procedure. Bleed air is available only to the left engine.

Limit start attempts to one autostart or two manual start attempts.

After left engine is started:

Ground pneumatic source (if used) ..... Disconnect

Center bleed ISOLATION switch ..... AUTO

Complete the normal Preflight, Before Start, and Engine Start procedures.

Engine Crossbleed Start

The APU must be shutdown or the APU Bleed switch must be turned off.

Verify the area behind the airplane is clear of equipment and personnel prior to increasing thrust on operating engine.

Thrust lever (operating engine) ..... Advance

Ships 7101 & Subsequent
Increase thrust until 5% N2 above idle (25 PSI minimum duct pressure).

Ships 7001 – 7008
Increase thrust until 5% N3 above idle (25 PSI minimum duct pressure).

Accomplish normal engine start.

Engine Ground Pneumatic Start

Duct pressure ..... Observe

[Observe duct pressure is a minimum of 25 PSI (less 1 PSI per 1000 feet of pressure altitude)].

Accomplish normal engine start one engine at a time.

Copyright © The Boeing Company. See title page for details.

Manual Engine Start - GE-90

Ships 7101 & Subsequent

Captain	First Officer
Announce start sequence.	Position AUTOSTART switch to OFF.
Call “START _____ ENGINE.”	Position _____ START/IGNITION selector to START.
Observe oil pressure increase.	
Position _____ FUEL CONTROL switch to RUN at maximum motoring (N2 acceleration less than approximately 1% in 5 seconds).	
Observe initial EGT rise and EGT within limits.	
	When engine is stabilized at idle, push AUTOSTART switch ON, if AUTOSTART is available. If more than one engine is to be started manually, AUTOSTART switch may remain OFF between manual starts.

Monitor engine displays for start parameters listed below until engine is stabilized at idle:

- Oil pressure should rise before selecting RUN.
- EGT should rise within 20 seconds after selecting RUN.
- N1 rotation must be indicated by 50% N2.
- EGT must stay within limits.
- N2 should reach idle within two minutes after selecting RUN.

If both engines are to be started manually, the AUTOSTART switch may remain OFF between manual starts.

Repeat procedure to start remaining engine.

Copyright © The Boeing Company. See title page for details.

Manual Engine Start - RR-895

Ships 7001 – 7008

Captain	First Officer
Announce start sequence.	Position AUTOSTART switch to OFF.
Call “START _____ ENGINE.”	Position _____ START selector to START.
Observe oil pressure increase.	
Position _____ FUEL CONTROL switch to RUN when: • EGT less than 100 degrees C, and • at maximum motoring speed, or N3 greater than 25%, whichever occurs first.	
Observe initial EGT rise and EGT within limits.	
	When engine is stabilized at idle, push AUTOSTART switch ON, if AUTOSTART is available. If more than one engine is to be started manually, AUTOSTART switch may remain OFF between manual starts.

Monitor engine displays for start parameters listed below until engine is stabilized at idle:

- Oil pressure should rise before selecting RUN.
- EGT should rise within 30 seconds after selecting RUN.
- N1 rotation must be indicated by 45% N3.
- EGT must stay within limits.
- N3 should reach idle within two minutes after selecting RUN.

If both engines are to be started manually, the AUTOSTART switch may remain OFF between manual starts.

Repeat procedure to start remaining engine.

Copyright © The Boeing Company. See title page for details.

Manual Override Engine Start

Start the engine using normal engine start procedure, except direct the ground crew to:

Ships 7101 & Subsequent

For GE90 engines:

- manually open the start valve after positioning START/IGNITION selector to START
- manually close the start valve at 62% N2.

Ships 7001 – 7008

For RR 895 engines:

- manually open the start valve after positioning START selector to START
- manually close the start valve at 50% N3.

Copyright © The Boeing Company. See title page for details.

Intentionally
Blank

Copyright © The Boeing Company. See title page for details.

Fire Warning System Test

FIRE/OVERHEAT TEST switch ..... Push and hold

Verify the following:

- Fire bell rings intermittently
- APU fire handle – Illumininated
- FWD and AFT CARGO FIRE warning lights – Illuminated
- Master WARNING light – Illuminated
- FIRE TEST IN PROGRESS EICAS message – Displayed
- FUEL CONTROL switches – Illuminated
- LEFT and RIGHT engine FIRE handles – Illuminated.

Note: The test is complete when the FIRE TEST PASS EICAS message is displayed.

FIRE/OVERHEAT TEST switch ..... Release

Copyright © The Boeing Company. See title page for details.

Intentionally
Blank

Copyright © The Boeing Company. See title page for details.

QFE Operation

This procedure is accomplished when ATC altitude assignments are referenced to QFE altimeter settings.

Note: Do not use LNAV and/or VNAV below transition altitude/level. Altitudes in the navigation database are not referenced to QFE. Use only raw data for navigation.

CDU APPROACH REF page ..... Select

LANDING REF key ..... Push

Verify QFE selected.

[This sets the landing altitude to zero.]

Altimeters ..... Set

Set altimeters to QFE when below transition altitude/level.

If the QFE altimeter setting is beyond the range of the altimeters, QNH procedures must be used with QNH set in the altimeters.

Copyright © The Boeing Company. See title page for details.

Intentionally
Blank

Copyright © The Boeing Company. See title page for details.

Fuel Balancing

If fuel leak is suspected:

Accomplish the FUEL LEAK checklist.

If fuel balancing is desired prior to display of the FUEL IMBALANCE alert message, accomplish the FUEL IMBALANCE non-normal checklist.

Copyright © The Boeing Company. See title page for details.

Intentionally
Blank

Copyright © The Boeing Company. See title page for details.

ADIRU Alignment/Position Update

If an ADIRU position update is desired during an automatic realignment (on ground only):

CDU – SET

When dash prompts appear on the SET INERTIAL POS line of the POS INIT page, enter the most accurate position.

If a manual ADIRU alignment is desired (on ground only):

ADIRU switch – OFF 30 seconds, then ON

Wait an additional 30 seconds.

CDU – SET

Enter the most accurate position on the SET INERTIAL POS line of the POS INIT page if either of the following is displayed on the SET INERTIAL POS line:

- box prompts appear, or
- a latitude/longitude position is displayed.

Alignment requires from six to fifteen minutes depending on latitude (six minutes at the equator, ten minutes average).

Copyright © The Boeing Company. See title page for details.

Double Derate Takeoff Procedure

Ships 7101 & Subsequent

A double derate takeoff is permitted when authorized by the WDR.

CAUTION: Do not use double derated thrust when conditions exist that affect braking (e.g., slush, snow, ice on runway), or when windshear conditions exist.

Before start:

THRUST LIM page ..... Select

Assumed Temperature ..... Enter

TO 1 or TO 2 ..... Select

Note: Selecting a double derate arms CLB and inhibits APU-to-Pack Takeoff.

Thrust reference mode ..... Check

Verify D-TO 1 or D-TO 2 displayed:

- at top of THRUST LIM page and
- at top of EICAS display in green.

CAUTION: With either TO 1 or TO 2 selected, the thrust setting parameters are a limitation for takeoff. Except in an emergency, the thrust levers should not be advanced further. A thrust increase following an engine failure could result in a loss of directional control.

Copyright © The Boeing Company. See title page for details.

FMS Position Update

When the FMC message VERIFY POSITION is displayed, the FMC position may require updating.

POS REF page 2/3 ..... Select

POS REF 2/3 is the second page of POS INIT 1/3.

Compare the FMS positions with the displayed GPS, RADIO, and INERTIAL positions.

Select the most appropriate source for FMC position updating.

UPDATE ARM key ..... Select

The ARM prompt changes to ARMED and NOW prompts appear to the right of the remaining position sources.

Appropriate source UPDATE NOW key ..... Push

Copyright © The Boeing Company. See title page for details.

Navaid Inhibit

Note: GPS position updates are allowed for all United States National Airspace approach operations. Outside of this region, GPS position updates are allowed during approaches only if the FMC database and approach charts are referenced to the WGS-84 reference datum. GPS updates should be inhibited for all other approach operations, unless other appropriate procedures are used.

To inhibit GPS:

POS REF page 3/3 ..... Select

POS REF 3/3 is the third page of POS INIT 1/3.

GPS NAV key ..... Push

Verify GPS NAV OFF selected.

To inhibit VORs, VOR/DMEs, VORTACs, or DMEs:

INIT REF key ..... Push

INDEX key ..... Push

NAV DATA key ..... Push

To inhibit all VOR/DME data:

VOR/DME NAV key ..... Push

Verify VOR/DME NAV OFF selected.

Enter identifiers of specific navaids or VORs to be inhibited on the NAVAID INHIBIT or VOR ONLY INHIBIT lines.

Copyright © The Boeing Company. See title page for details.

Navigation Accuracy Check

The following check must be performed prior to entering Class II airspace. Completion should be annotated on International Flight Plan.

POS REF page 2/3 ..... Select

POS REF 2/3 is the second page of POS INIT 1/3.

Verify RNP and ANP are displayed and that ANP is lower than RNP.

Flight plan ..... Annotate

Place check in flight plan block indicating the navigation accuracy check has been completed

Note: An "NAV UNABLE RNP" EICAS message will not be displayed if ANP is less than RNP.

RNP Manual Entry

The FMC automatically supplies default RNP values based on phase of flight. When the airplane is on a procedure or airway that has an RNP requirement, and does not have an RNP value stored in the navigation database, a manual RNP entry may be made.

POS REF page 2/3 ..... Select

POS REF 2/3 is the second page of POS INIT 1/3.

If the displayed RNP is different from the RNP for the current airway or procedure:

RNP ..... Enter

When the manually entered RNP is no longer required:

POS REF page 2/3 ..... Select

RNP ..... Delete

Copyright © The Boeing Company. See title page for details.

FMS Waypoint Loading Procedure

Unnamed oceanic waypoints in all theaters of operation are to be loaded via FMS LAT/LONG format.

Example: Position N4300.0/E17000.0 can be loaded as either N43E170 or N4300.0E17000.0.

Waypoint loading is verified by line selecting the entry from the LEGS page into the scratchpad; check the entered coordinates against the full LAT/LONG coordinates on the flight plan. Verification on the FMC NAV DATA page is no longer required.

Position reports can be made via CPDLC utilizing the ATC Position Report Page for named and unnamed waypoints in Tokyo (RJTG), Oakland (KZAK), and Magadan (GDXB) FIRs. Anchorage (PAZA) requests position reporting via VHF radio.

Considerations

The FMS FIX page will only accept waypoints from the navigation database. If crews desire to enter the point on the fix page for reference, they will need to type in the ARINC 424 format (e.g., 43E70).

It is not possible to line select the unnamed waypoints to the scratchpad on the LEGS page and enter it into the ACARS for Company Position Reports. These waypoints will need to be manually loaded as either 43N170E or 43E70 format.

Automatic ADS position reporting will remain unchanged in FIRs currently utilizing ADS position reports (e.g., NATS).

All other waypoint loading/verification procedures will remain unchanged.
This procedure applies to all B-777 operations.

Copyright © The Boeing Company. See title page for details.

RNAV Departure/Arrival Procedures

Note: Notify ATC of any degradation of performance or inability of the FMS to provide accurate navigation and request amended clearance.

During Preflight

Ensure the waypoints, speed, and altitude constraints of the RNAV SID selected from the database match those depicted on the published Jeppesen procedure for the departure runway.

Before Takeoff

Verify the selected runway, departure, and associated first fix in the FMS match the latest ATC departure clearance.

Verbalize the runway, departure procedure, and first fix.

During/After Takeoff

Pay close attention to takeoff clearance. "Delta 123, cleared for takeoff" is the standard clearance issued to fly the RNAV SID as published.

Use of the autopilot is strongly encouraged. Optimum course adherence is ensured if the autopilot is engaged at approximately 1,000 ft. AFE.

Whenever a significant course change is depicted, expect the FMC to use turn anticipation for fly-by waypoints (waypoints depicted on Jeppesen charts without a circle around them).

RNAV SID/STAR design is based on path-keeping accuracy within 0.5 nm. Pilots may use the base of the airplane symbol on 10 nm scope (the base of the airplane symbol represents approximately 1 nm on the 10 nm scope) or the appropriate progress page in the FMS to monitor path-keeping accuracy.

Arrival

Some RNAV STARs are runway specific. Ensure the waypoints, speed, and altitude constraints of the RNAV STAR selected from the database match those depicted on the published Jeppesen procedure for your arrival runway.

Note: There is no requirement to enter a specific RNP value or to monitor raw data.

Copyright © The Boeing Company. See title page for details.

Runway Change Procedure

Note: Refer to Airway Manual 10-0 green pages for specific runway considerations.

Two crew members must refer to the final AWABS/WDR to verify the takeoff performance and configuration data.

FMS data ..... Set

DEP ARR key – Push

Select new runway and departure procedure.

INIT REF key – Push

TAKEOFF – Select

Selection displays TAKEOFF REF page 1/2.

Enter FLAPS setting.

Enter THRUST setting
- Full thrust
- Assumed Temperature derate.

Check TRIM setting.

Check RUNWAY/POSITION (if intersection takeoff)

Check V1, V2, VR speeds.

NEXT PAGE key – Push

Displays TAKEOFF REF page 2/2.

Verify the following items:
- ENGINE OUT ACCELERATION HEIGHT
- ACCELERATION HEIGHT
- THRUST REDUCTION point.

ROUTE key – Push

Check for route discontinuity.

Runway, departure, first fix ..... ___, ___, ___

Verify the selected runway, departure, and associated first fix in the FMS match the latest ATC departure clearance.

Copyright © The Boeing Company. See title page for details.

Verbalize the runway, departure procedure, and first fix.

Check aircraft versus runway position on ND (10nm scale.)

Flaps .....Set

Move FLAP lever to takeoff setting as required by AWABS and verify position of the flaps on the EICAS.

Trim ..... ___ Units, zero, zero

Stabilizer trim – ___ UNITS

Set the trim for takeoff.

Verify that the trim is in the greenband.

Aileron trim – 0 units

Rudder trim – 0 units

Mode Control Panel .....Set

IAS/MACH selector – Set V2

Arm LNAV as required.

Verify VNAV is armed.

Initial heading or track – Set

Initial altitude – Set

Departure briefing..... Complete

Review any changes to original departure briefing to include green pages, threats, etc.

Call "RUNWAY CHANGE CHECKLIST."

Read the RUNWAY CHANGE checklist.

Copyright © The Boeing Company. See title page for details.

Takeoff Bump Thrust Procedure

Ships 7101 & Subsequent

Takeoff bump thrust is permitted when authorized by the WDR.

Before start:

THRUST LIM page ..... Select

TO B (Takeoff Bump) ..... Select

Note: Selecting TO B selects additional takeoff thrust, arms CLB, and inhibits the Assumed Temperature derate.

Thrust reference mode .....Check

Verify TO B displayed:

- at top of THRUST LIM page and
- at top of EICAS display in green.

If APU-to-Pack Takeoff is accomplished concurrently with Takeoff Bump (typical):

Verify A-TO B displayed:

- at top of THRUST LIM page and
- at top of EICAS display in green.

Copyright © The Boeing Company. See title page for details.

Introduction

Airplane operation in adverse weather conditions may require additional considerations due to the effects of extreme temperatures, precipitation, turbulence, and windshear. Procedures in this section supplement normal procedures and should be observed when applicable.

Cold Weather Operations

Considerations associated with cold weather operation are primarily concerned with low temperatures and with ice and snow on the airplane, ramps, taxiways, and runways.

Icing conditions exist when OAT (on the ground) or TAT (in-flight) is 10°C or below and:

- visible moisture (clouds, rain, snow, sleet, ice crystals, fog with visibility less than one statute mile (1600 m), and so on) is present, or
- standing water, ice, or snow is present on the ramps, taxiways, or runways.

CAUTION: Do not use engine anti-ice when OAT (on the ground) is above 10°C. Do not use engine or wing anti-ice when TAT (in-flight) is above 10°C.

Preliminary Preflight

For flight deck preparation and ground operation, use normal air conditioning procedures, with all packs, trim air, and recirculation fans on, to provide cabin heating, unless ground conditioned air is utilized. Keep airplane windows and doors closed as much as possible to limit heat loss.

After extended cold soaking, equipment or systems may not operate or start when initially selected on. Should this occur, the control may be cycled OFF then ON one time to restore operation.

If any area will require special attention during deicing, coordinate with the ground crew.

Copyright © Delta Air Lines, Inc. See title page for details.

Exterior Inspection

Although removal of surface snow, ice and frost is normally a maintenance function, during preflight procedures, the captain or first officer should carefully inspect areas where surface snow or frost could change or affect normal system operations.

Do the normal Exterior Inspection with the following additional steps:

Surfaces ..... Check

Takeoff with light coatings of frost, up to 1/8 inch (3mm) in thickness on lower wing surfaces due to cold fuel is permissible; however, all leading edge devices, all control surfaces, and upper wing surfaces must be free of snow or ice.

Thin hoarfrost is acceptable on the upper surface of the fuselage provided all vents and ports are clear. Thin hoarfrost is a uniform white deposit of fine crystalline texture, which usually occurs on exposed surfaces on a cold and cloudless night, and which is thin enough to distinguish surface features underneath, such as paint lines, markings or lettering.

Pitot probes and static ports ..... Check

Verify that all pitot probes and static ports are free of snow and ice. Water rundown after snow removal may freeze immediately forward of static ports and cause an ice buildup which disturbs airflow over the static ports resulting in erroneous static readings even when static ports are clear.

Air conditioning inlets and exits ..... Check

Verify that the air inlets and exits, including the outflow valves, are free of snow and ice.

Engine inlets ..... Check

Verify that the inlet cowling is free of snow and ice.

Fuel tank vents ..... Check

Verify that all traces of ice and frost are removed.

Landing gear doors ..... Check

Landing gear doors should be free of snow and ice.

APU air inlets ..... Check

The APU inlet door must be free of snow and ice before APU start.

Copyright © Delta Air Lines, Inc. See title page for details.

Engine Start Procedure

Do the normal Engine Start Procedure with the following considerations:

- Oil pressure may be slow to rise
- Initial oil pressure rise may be higher than normal
- Additional warm-up time may be needed to allow oil temperature to reach the normal range.
- Displays may require additional warm-up time before displayed engine indications accurately show changing values. Displays may appear less bright than normal.

Engine Anti-ice Operation - On the Ground

Engine anti-ice must be selected ON immediately after both engines are started and remain on during all ground operations when icing conditions exist or are anticipated, except when the temperature is below –40°C OAT.

WARNING: Do not rely on airframe visual icing cues before activating engine anti–ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

CAUTION: Do not use engine anti-ice when OAT is above 10°C.

When engine anti-ice is needed:

ENGINE ANTI-ICE selectors ..... ON

When engine anti-ice is no longer needed:

ENGINE ANTI-ICE selectors ..... AUTO

Before Taxi Procedure

Do the normal Before Taxi Procedure with the following modifications:

If taxi route is through slush or standing water in low temperatures or if precipitation is falling with temperatures below freezing, taxi out with the flaps up. Taxiing with the flaps extended subjects the flaps and flap drives to snow and slush accumulations from the main gear wheels. Leading edge devices are also susceptible to slush accumulations.

Call “FLAPS ___” as required.

Flap lever ..... Set flaps, as required

Copyright © Delta Air Lines, Inc. See title page for details.

Taxi–Out

CAUTION: Taxi at a reduced speed. Use smaller tiller and rudder inputs, and apply minimum thrust evenly and smoothly. Taxiing on slippery taxiways or runways at excessive speed or with high crosswinds may start a skid.

When engine anti-ice is required and the OAT is 3°C or below, do an engine run up, as required, to minimize ice build-up. Use the following procedure:

Check that the area behind the airplane is clear.

Run-up to a minimum of 50% N1 for approximately 1 second duration at intervals of no greater than 45 minutes.

De-icing / Anti-icing

Testing of undiluted de-icing/anti-icing fluids has shown that some of the fluid remains on the wing during takeoff rotation and initial climb. The residual fluid causes a temporary decrease in lift and increase in drag, however, the effects are temporary. Takeoff operations with reduced thrust (assumed temperature method or fixed derate) are permitted provided takeoff performance accounts for the runway surface condition. Use the normal takeoff rotation rate.

CAUTION: Operate the APU during de-icing only if necessary. If the APU is running, ingestion of de-icing fluid causes objectionable fumes and odors to enter the airplane. Ingestion of snow, slush, ice, or de-icing/anti-icing fluid can also cause damage to the APU.

If de-icing / anti-icing is needed:

APU ..... As required

The APU should be shut down unless APU operation is necessary.

Call “FLAPS UP”.

Flaps ..... UP

Prevents ice and slush from accumulating in flap cavities during de-icing.

Copyright © Delta Air Lines, Inc. See title page for details.

Thrust levers ..... Close

Reduces the possibility of injury to personnel at inlet or exhaust areas.

PACK switches ..... OFF

Wait approximately 10 seconds after pack switches are off before positioning bleed switches to off to reduce pack wear.

ENGINE bleed switches (engines running) ..... OFF

Reduces the possibility of fumes entering the air conditioning system.

APU bleed switch (APU running) ..... OFF

Reduces the possibility of fumes entering the air conditioning system.

After de-icing / anti-icing is completed:

APU ..... As required

Wait approximately one minute after de-icing is completed to restore engine and APU bleed air and pack operation to ensure all de-icing fluid has been cleared from the engines:

PACK switches ..... AUTO

ENGINE bleed switches ..... ON

APU bleed switch ..... ON

Before Takeoff Procedure

Snow, slush, standing water and ice affect takeoff performance. Slush and standing water affect acceleration. Precipitation in any form affects stopping capability. For performance corrections, see ARM. Takeoff, acceleration - stop distances and V1 speeds are based on smooth, dry, hard surfaced runways.

Do the normal Before Takeoff Procedure with the following modification:

Call "FLAPS __" as required for takeoff.

Continued on next page

Copyright © Delta Air Lines, Inc. See title page for details.

Continued from previous page

Flap lever ..... Set takeoff flaps, as required

Extend the flaps to the takeoff setting at this time if they have been held because of slush, standing water, or icing conditions, or because exterior de-icing / anti-icing.

Ships 7001 – 7008

Engine oil temperature ..... Minimum 50°C

Oil temperature must be at least 50°C before takeoff.

Takeoff Procedure

Do the normal Takeoff Procedure with the following modification:

When engine anti-ice is required and the OAT is 3°C or below, the takeoff must be preceded by a static engine run-up. Use the following procedure:

7101 & Subsequent

Run-up to as high a thrust setting as practical and confirm stable engine operation before the start of the takeoff roll.

7001 – 7008

Run-up to a minimum of 50% N1 and confirm stable engine operation before the start of the takeoff roll.

Rejected Takeoff

When aborting a takeoff on a slippery runway, extend spoilers if not deployed and use maximum allowable symmetrical reverse thrust. If a side slip develops, correct back to centerline by reducing reverse thrust to reverse idle and releasing brakes. This allows the tire cornering forces to be used for realignment to runway centerline. Use rudder, steering and differential braking, as required, to prevent over correcting past the centerline. When re-established on centerline, apply maximum braking and reverse thrust to stop the aircraft.

Copyright © Delta Air Lines, Inc. See title page for details.

Engine Anti-ice Operation - In-flight

Engine anti–ice must be AUTO or ON during all flight operations when icing conditions exist or are anticipated, except when the temperature is below –40°C SAT.

CAUTION: Do not use engine anti-ice when TAT is above 10°C.

Manual Use of Engine Anti-ice

When using the engine anti-ice system manually in areas of possible icing, activate engine anti–ice before entering icing conditions.

WARNING: If using the engine anti–ice system manually, do not rely on airframe visual icing cues before activating engine anti–ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

When manual use of engine anti-ice is needed:

ENGINE ANTI–ICE selectors ..... ON

When manual use of engine anti-ice is no longer needed:

ENGINE ANTI–ICE selectors ..... AUTO

Fan Ice Removal

CAUTION: Avoid prolonged operation in moderate to severe icing conditions.

If moderate to severe icing conditions are encountered:

Ships 7101 & Subsequent

During flight in moderate to severe icing conditions for prolonged periods with N1 settings at or below 70%, or when fan icing is suspected due to high engine vibration, the fan blades must be cleared of any ice. Do the following procedure every 15 minutes on both engines, one engine at a time: reduce thrust toward idle then increase to a minimum of 70% N1 for 10 to 30 seconds.

Note: Operation in icing conditions may result in displayed vibration levels up to and exceeding the normal operating range. Extended operation at high vibration levels in icing conditions will not result in engine damage.

Copyright © Delta Air Lines, Inc. See title page for details.

Ships 7001 – 7008

During flight in moderate to severe icing conditions for prolonged periods, if fan icing is suspected due to high engine vibration, the fan blades must be cleared of any ice. Do the following procedure on both engines, one engine at a time: quickly reduce thrust to idle for 5 seconds then restore the required thrust. If vibration persists, advance thrust lever to 90% N1 momentarily.

Wing Anti-ice Operation - In-flight

Ice accumulation on the flight deck window frames, windshield center post, or windshield wiper arm, or side windows may be used as an indication of structural icing conditions and the need to turn on wing anti–ice.

The wing anti–ice system may be used as a de–icer or anti–icer in flight only. The primary method is to use the automatic ice detection system which acts as a de–icer by allowing ice to accumulate before turning wing anti–ice on. This procedure provides the cleanest airfoil surface, the least possible runback ice formation, and the least thrust and fuel penalty.

The secondary method is to select the WING ANTI–ICE selector ON when wing icing is possible and use the system as an anti–icer.

The airplane is capable of continued safe flight and landing in icing conditions in the event of an in-flight failure of the wing anti-ice system.

CAUTION: Do not use wing anti-ice when TAT is above 10°C (ANTI-ICE ON advisory message).

Manual Use of Wing Anti-ice

When manual use of wing anti–ice is needed:

WING ANTI–ICE selector ..... ON

When manual use of wing anti–ice is no longer needed:

WING ANTI–ICE selector ..... AUTO

Copyright © Delta Air Lines, Inc. See title page for details.

Landing

To minimize stopping distance on a contaminated runway, do the normal Landing Procedure with the following modifications:

Use autobrakes for maximum stopping effectiveness, avoid excessive approach speed, touchdown within 1,500 feet from the approach end of the runway, assure spoilers deploy, and use maximum allowable symmetrical reverse thrust.

Avoid abrupt steering inputs. If side slipping off the runway, select reverse idle and release brakes to return to centerline. The aircraft will tend to drift off the runway nose first with forward thrust and tail first with reverse thrust.

Reduce reverse thrust to reverse idle prior to 60 knots. The thrust levers should be positioned to reverse idle by taxi speed, then to full down after the engines have decelerated to idle.

Note: Reverse thrust may reduce forward visibility due to blowing snow.

After Landing Procedure

CAUTION: Taxi at a reduced speed. Use smaller tiller and rudder inputs, and apply minimum thrust evenly and smoothly. Taxiing on slippery taxiways or runways at excessive speed or with high crosswinds may start a skid.

Do the normal After Landing Procedure with the following modifications:

After prolonged operation in icing conditions with the flaps extended, or when an accumulation of airframe ice is observed, or when landing on a runway contaminated with ice, snow, or slush:

Do not retract the flaps until the flap areas have been checked to be free of contaminants.

Engine anti-ice must be selected ON and remain on during all ground operations when icing conditions exist or are anticipated, except when the temperature is below –40°C OAT.

Continued on next page

Copyright © Delta Air Lines, Inc. See title page for details.

Continued from previous page

WARNING: Do not rely on airframe visual icing cues before activating engine anti–ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

CAUTION: Do not use engine anti-ice when OAT is above 10°C.

When engine anti-ice is needed:

ENGINE ANTI-ICE selectors ..... ON

When engine anti-ice is no longer needed:

ENGINE ANTI-ICE selectors ..... AUTO

When engine anti-ice is required and the OAT is 3°C or below, do an engine run up, as required, to minimize ice build-up. Use the following procedure:

Check that the area behind the airplane is clear.

Run-up to a minimum of 50% N1 for approximately 1 second duration at intervals of no greater than 45 minutes.

Secure Procedure

Do the normal Secure Procedure with the following modifications:

If the airplane will be attended:

PACK switches ..... AUTO

If the airplane will not be attended, or if staying overnight at off-line stations or at airports where normal support is not available, the flight crew must arrange for or verify that the following steps are done:

OUTFLOW VALVE switches .....MAN

OUTFLOW VALVE MANUAL switches ..... CLOSE

Position the outflow valves fully closed to inhibit the intake of snow or ice.

Wheel chocks .....Verify in place

Copyright © Delta Air Lines, Inc. See title page for details.

Parking brake ..... Released

Reduces the possibility of frozen brakes.

Protective covers and plugs .....Install

Protects airplane and engines from snow and ice.

Water storage tanks and containers ..... Drain

Protects tanks and containers from freezing.

Toilets .....Drain

Protects toilets from freezing.

Doors and side windows ..... Close

Cold weather maintenance procedures for securing the airplane may be required. These procedures are found in the approved Aircraft Maintenance Manual.

Copyright © Delta Air Lines, Inc. See title page for details.

Intentionally
Blank

Copyright © Delta Air Lines, Inc. See title page for details.

Ground De/Anti-Icing

Definitions and Concepts

Ground de/anti-icing background information and policies are described in this section and the Airway Manual, Weather - Icing. Procedures for aircraft specific de/anti-icing are located in this section.

Deicing

Deicing is the procedure of removing frost, ice, slush, or snow from the aircraft in order to provide clean surfaces. On the ground this may be accomplished by:

- Using any mechanical or pneumatic means that will not damage the aircraft.
- Using heated deicing fluid to remove all forms of frozen contamination (including environmental frost). Heated fluids penetrate the frozen contaminants and contact the aircraft skin. The high thermal conductivity of the aircraft skin causes the heat to spread, breaking the bond of the ice and snow, causing it to melt or fall off the aircraft.

Anti-icing

Anti-icing is a precautionary procedure that provides protection against the formation of frost or ice, and accumulation of snow or slush on treated surfaces of the aircraft for a limited period of time (holdover time). Anti-icing fluid is the only protection against airfoil icing prior to getting airborne. Therefore, fluid application should be completed as close to takeoff time as possible.

De/Anti-icing

A combination of the deicing and anti-icing procedures.

Secondary De/Anti-icing

If an aircraft which has been de/anti-iced is delayed on the ground long enough that anti-icing protection is no longer effective, or if for any reason the de/anti-icing process is interrupted while freezing/frozen precipitation is falling, the ground de/anti-icing procedure must be reaccomplished in its entirety. This is referred to as secondary de/anti-icing.

Copyright © Delta Air Lines, Inc. See title page for details.

When secondary de/anti-icing is necessary, the contaminated anti-icing fluid and all frozen contamination must be completely removed by deicing before making another application of anti-icing fluid. If a holdover time was previously established after completing secondary de/anti-icing, a new holdover time must be determined.

Clean Aircraft Concept

The airline industry, in concert with the FAA, is operating with a clean aircraft concept to minimize the effects of all forms of frozen contamination on aircraft surfaces.

Takeoff is prohibited when frost, ice, snow or slush is adhering to the wings, control surfaces, engine inlets, or other critical surfaces of the aircraft.

- Do not rely on air flow during takeoff roll to remove frozen precipitation that may be adhering to the aircraft.
- A coating of frost up to 1/8 inch thick on the lower wing surface, below the fuel tank area, is permissible provided it is caused by cold soaked fuel.
- A thin coating of frost is permitted on the fuselage, provided letter and paint lines are visible through the frost.

Cold soaked wings

A cold soaked wing condition can occur when an aircraft lands with a large amount of fuel remaining in the wing tanks. During cruise at high altitude, the aircraft is subjected to extremely cold temperatures for an extended period of time causing the aircraft skin and fuel to become super cooled. If enough super cooled fuel is remaining in the wing tanks to contact the upper wing surface, it will maintain the skin at a temperature below freezing. When this happens, any moisture contacting the upper wing surface may form frozen contamination, even in ambient air temperatures as high as 15°C (60°F).

For all other aircraft, a cold soaked wing should only be suspected if both of the following conditions are met.

- Frost or ice is observed on the wing's underside during the walk around, and
- A large amount of fuel was remaining in the wing tanks after landing.

Copyright © Delta Air Lines, Inc. See title page for details.

If cold soaked wings are suspected, cabin windows may be used during the preflight to visually inspect the upper wing surfaces for frost or ice. The quickest way to alleviate a cold soaked wing condition is to add warm fuel to the wing tanks.

Critical Aircraft Surfaces

Critical aircraft surfaces are those surfaces which must be clear of adhering frozen contamination before beginning takeoff roll. Critical aircraft surfaces include, but may not be limited to:

- Wings, slats, flaps, ailerons, spoilers.
- Horizontal stabilizer and elevator.
- Vertical stabilizer and rudder.
- Pitot heads, static ports, ram-air intakes, engine and flight instrument probes, other kinds of instrument sensor pickups.
- Engine and APU inlets and exhausts.
- Landing gear and landing gear doors.
- Fuel vents.
- Radome

Representative Aircraft Surfaces

Representative aircraft surfaces are those which the pilot can readily observe to determine whether or not frost, ice, or snow is accumulating or forming on that surface. By using a representative surface, a pilot can make a reasoned judgement regarding whether or not frost, ice, or snow is adhering to other aircraft surfaces.

Representative aircraft surfaces visible from the flight deck are:

- Fuselage.
- Radome.

Representative aircraft surfaces visible from the best vantage point(s) in the cabin are:

- Wing area upper surfaces.
- Wing leading edges.
- Engine inlets.

Copyright © Delta Air Lines, Inc. See title page for details.

Best Vantage Point(s)

The best vantage point is the location in the aircraft where a pilot can best check representative aircraft surfaces. This will normally be a passenger window in the over-wing area. It may be necessary in some circumstances to move forward a few rows to get the best view of the engines. Outside lighting conditions and glare may also affect which specific location is the best vantage point.

Holdover Time

Holdover time is the estimated time that anti-icing fluid will prevent the formation of frozen contaminants on the treated surfaces of the aircraft. Holdover time is determined by the pilot using the Holdover Time Tables.

Holdover time starts when the final application of fluid begins. The final fluid applied will be either:

- De/Anti-icing fluid in the one step procedure, or
- Anti-icing fluid in the two step procedure.

Holdover time ends when either:

- The applied fluid loses its effectiveness, or
- The time extracted from the holdover time range expires.

Ground Icing Conditions

Guidance for determining precipitation categories (type) and intensities (light, moderate, and heavy) is located in the Airway Manual, Weather, Hazardous Weather - Icing.

WARNING: Do not take off during hail, moderate or heavy freezing rain, snow pellets, or heavy ice pellets.

Operational Effects of Frozen Contamination

Frost, ice, and/or snow adhering to airfoils, engine inlets, flight controls and flight instrument sensors, even in small amounts, can have a critical effect on aircraft performance. For example, ice formations on the wing's leading edges and upper surfaces creating texture roughness of medium to coarse sandpaper can reduce lift as much as 30 percent and increase drag by 40 percent. Therefore, frozen contamination on the aircraft in any form poses a serious threat to flight safety due to degraded operational performance.

Copyright © Delta Air Lines, Inc. See title page for details.

Degraded aerodynamic performance such as:

- Lift decreases - Frozen contamination may destroy the lifting ability of an airfoil, including leading edge devices. The aircraft may not lift off at a normal pitch attitude. Required gaps in leading edge devices may be blocked and further reduce lift on one or both wings.
- Drag/weight increases - An aircraft may fail to reach takeoff speed in the calculated distance.
- Stall speed increases - Buffet or stall may occur before activation of stall warning systems.
- Controllability decreases - Caused by changing the aerodynamic properties of the control surface due to ice. For example, ice on the leading edge of the horizontal stabilizer can affect pitch control, especially during rotation.

Reduction in available engine power caused by:

- Icing of engine inlets, guide vanes or compressor blades.
- Ingestion of ice shedding from other parts of the aircraft.

Impairment of flight and engine performance indicators resulting in:

- Incorrect power settings due to EPR probe icing.
- Incorrect airspeed indication caused by pitot/static probe icing.
- Erroneous stall warning caused by ice on the AOA probe.

Degraded flight control response as ice may interfere with the free movement of the flight controls.

Delta De/Anti-icing Program

Delta Air Lines' Ground De/Anti-icing Program is coordinated among Airport Customer Service, Maintenance, Flight Control, Flight Operations, Fleet Management and Reliability, and Flight Safety. Each Delta deicing station will have designated trained personnel on duty to determine when to initiate ground de/anti-icing operations. At airports where no Delta personnel are permanently assigned, the Captain may declare the de/anti-icing program in effect. In this case, the Captain shares responsibility for the effectiveness of the effort with the ground crew. The procedures outlined in this section will help guide the Captain through this decision making process.

There are several components to Delta's De/Anti-icing Program. Pilots need to be aware of how key components play an integral part in ensuring safe winter flight operations.

Copyright © Delta Air Lines, Inc. See title page for details.

De/Anti-icing Alert Plan

A Deicing Alert Chart will be issued daily by Delta Meteorology to the OCC Duty Director. This chart reflects forecasted freezing/frozen precipitation for specific geographic regions for the next day's flying (24 - 48 hours in advance). Affected stations will be notified, and plans will be made to initiate local de/anti-icing operations. Flight Control will work in conjunction with individual stations to determine possible changes to the flight schedule based on any anticipated decrease in airport air traffic capacity.

Station De/Anti-icing Plans

Each Delta station that conducts de/anti-icing operations is required to have a detailed de/anti-icing plan on file. This plan contains, but is not limited to the following information:

- Persons responsible for implementing/terminating the de/anti-icing plan.
- Deicing equipment and fluids.
- Location of de/anti-icing areas.
- Local procedures including communication with the flight crew and coordination with local ATC.

ATC will be notified whenever the local de/anti-icing plan is in effect. Departure runway queues will be managed by ATC in order to minimize the amount of time an aircraft spends on the ground after being de/anti-iced.

Special procedures for the pilots will be contained in the Airway Manual, 10-0 Delta Special Pages (green pages), or noted in the Airport Remarks section of the flight plan.

Responsibility for De/Anti-icing of Aircraft

The Captain has the ultimate responsibility for ensuring the aircraft's critical surfaces are free of frozen contamination and the flight can be operated safely. The ground deicing crew shares in this responsibility by providing an aircraft that complies with the clean aircraft concept.

Normally, aircraft de/anti-icing will be performed by:

- Delta Maintenance.
- Airport Customer Service (ACS).
- Business partner (contractor).
- Any combination of the above.

Copyright © Delta Air Lines, Inc. See title page for details.

ACS and/or contractors accomplish the majority of aircraft de/anti-icing. As always, pilot vigilance is paramount during any de/anti-icing procedure. If possible, the pilots should evaluate the operation from the flight deck as it is being conducted and:

- If deicing or anti-icing is not being performed properly and safety is jeopardized, stop the operation and attempt to have the problem corrected.
- When possible, provide timely feedback on individual station de/anti-icing performance to the Dispatcher. A telephone report is preferred.
- Document all de/anti-icing problems or kudos on a COR.

Depending on the circumstances and local station procedures, aircraft de/anti-icing may be accomplished:

- Whenever requested by the Captain.
- Prior to taxiing into the gate (to prevent accumulation).
- During overnight parking (prior to pilots' arrival).
- At the gate - prior to pushback.
- After pushback - clear of the gate.
- During taxi operations, i.e., car wash.

Deicing at Offline Stations

If de/anti-icing is required at an offline station, consult with Flight Control.

In unusual circumstances, such as when operating at an offline station, the pilots may be required to supervise the de/anti-icing operation. In this case, the pilots must ensure the aircraft is free of frozen contamination in accordance with the clean aircraft concept. If the Captain determines that the pilots are unable to effectively supervise the de/anti-icing procedure, the flight will not operate.

Note: Contact the Dispatcher if a noncertified fluid must be used. Refer to Noncertified Fluids section in this chapter.

Copyright © Delta Air Lines, Inc. See title page for details.

De/Anti-icing Fluids

Type I Fluid

Type I fluid is a deicing and anti-icing fluid with low viscosity and is considered an unthickened fluid. It forms a very thin wetting film on aircraft surfaces and has excellent deicing properties. Type I fluid can be orange-colored or colorless. Due to its low viscosity, it provides minimal anti-icing protection. Type I fluid is always diluted because adding water ensures fluid freeze point protection and ensures proper aerodynamic flow-off characteristics. Type I fluid is never applied 100 percent. Different dilution ratios of Type I fluids affect the freeze point of the fluid, but do not alter its holdover time significantly. Consequently, there are no ratio break outs on the Type I Holdover Time Table. The Type I Holdover Table will apply when this fluid is used.

Type II Fluid

Type II fluid is a deicing and anti-icing fluid of high viscosity and is considered a thickened fluid. It adheres to the aircraft surfaces to provide a protective film. It creates a thicker layer than Type I fluid and thus has improved anti-icing capability. Type II fluid can be straw-colored or colorless. Airflow during takeoff roll causes the fluid to shed so that by rotation the surfaces are aerodynamically clean. Varying concentration levels of Type II fluid affect its holdover time. Delta prefers to use 100 percent concentration of Type II fluid, but other concentration levels may be used at contract or overseas facilities. Not all stations will have Type II available. The Type II Holdover Table will apply when this fluid is used.

Type III Fluid

Type III fluid is a deicing and anti-icing fluid with longer [holdover] times than Type I fluid, but lower viscosity than Type IV fluids. It was primarily designed for use on aircraft with slower rotation speeds to ease shedding of the fluid during takeoff, but it is fully approved for use on Delta aircraft. Type III fluid is bright yellow in color. Few stations are expected to have Type III fluid available. The Type III Holdover Table will apply when this fluid is used.

Type III fluid or fluid/water mixtures are normally applied heated when used for deicing (contamination removal), but may be heated or unheated for anti-icing (surface protection).

Copyright © Delta Air Lines, Inc. See title page for details.

Type IV Fluid

Type IV fluid is an enhanced performance deicing and anti-icing fluid with characteristics similar to Type II. Type IV fluid is green colored, except in Japan, where it is colorless. Its anti-icing effectiveness is superior to Type II fluid and holdover time is increased by a significant factor under most conditions. There is a separate Holdover Time Table for Type IV which reflects this improved performance. Additionally, Type IV fluid has some unique visual characteristics. It is pale green in color and considerably thicker than Type II fluid. When applied to the wings, the extra thickness may cause the fluid to appear wavy or bumpy. Varying concentration levels of Type IV fluid affect its holdover time. Delta prefers to use 100 percent concentration of Type IV, but other concentration levels may be used at contract or overseas facilities. Not all stations will have Type IV available. The Type IV Holdover Table will apply when this fluid is used.

Some contract deicing ground crews may communicate a specific brand of Type IV fluid during the Post De/Anti-icing Report, for example, "Type IV, Octagon, Max-Flight." Flight crews should disregard the fluid brand information and utilize the Type IV Holdover Time Table.

Noncertified Fluids

A de/anti-icing fluid that does not meet SAE/ISO certification requirements (including military fluids) is classified as noncertified, Type I, Type II, Type III, or Type IV fluid. These fluids may be encountered at certain international stations, or during offline operations at military bases. The use of noncertified Type I fluid is not authorized for takeoff during active icing conditions. Contact the Dispatcher if a noncertified Type I fluid is used. Noncertified Type II, Type III, or Type IV fluids are not authorized under any circumstances.

Fluid Standards

Deicing fluids are:

- Heated water when OAT is above or equal to -3°C (27°F).
- Heated water mixed with Type I fluid.
- Heated water mixed with one of the following SAE/ISO fluids:
  - Type II, or
  - Type III, or
  - Type IV.

Copyright © Delta Air Lines, Inc. See title page for details.

Anti-icing fluids must be certified by the:

- Society of Automotive Engineers (SAE).
- International Standards Organization (ISO).

Anti-icing fluids are:

- Heated or unheated water mixed with one of the following SAE/ISO fluids:
  - Type I,
  - Type II,
  - Type III, or
  - Type IV.
- Undiluted SAE/ISO Type II fluid.
- Undiluted SAE Type III fluid
- Undiluted SAE/ISO Type IV fluid

All de/anti-icing fluids have a limit to their low operational temperature use. Ground deicing crews and Dispatchers have access to this information in the Technical Operations Policies and Procedures (TOPP) 20-30-05. The following is an approximate low temperature limit of the fluids:

- Type I has the lowest temperature use, approximately -30°C (-22°F)
- Type II and IV are approximately -25°C (-13°F)
- Type III is approximately -29°C (-20°F)

Under extremely low temperature conditions consider using alternate means of deicing, such as brooms or nonheated forced air.

Fluid Effects on Braking and Steering

Generally, Type I, Type II, Type III, and Type IV fluids are considered to have the same affect on braking and steering as water.

CAUTION: A slippery condition may exist in and around the de/anti-icing ramp and taxi ways, particularly during dry weather conditions or light precipitation.

De/Anti-icing Fluid vs. Hydraulic Fluid

It is very difficult to distinguish between de/anti-icing fluids and hydraulic fluid. In small quantities and thin coatings, both fluids will have similar coloring and feel slippery to the touch. During the exterior inspection, if residual fluids on aircraft surfaces cannot be identified, contact local Maintenance or call the MCC through the Dispatcher for guidance.

Copyright © Delta Air Lines, Inc. See title page for details.

Fluid Application Methods

De/anti-icing can be performed using a one or two step procedure.

- One step procedure - This procedure is a combination of deicing and anti-icing performed at the same time with the same fluid (de/anti-icing). The fluid used to deice the aircraft is always heated and remains on the surface to provide anti-icing protection. This procedure can be repeated so as to minimize the time required to complete the final application of fluid.
- Two step procedure - This procedure consists of two distinct fluid applications. The first step, deicing with a heated fluid, is followed by the second step, anti-icing, as a separate fluid application. Normally, Type II or Type IV fluid is used during the second step; however, Type I or Type III fluid may be used.

Note: Areas in front of the most forward passenger door are normally treated only with Type I or Type III fluid. International stations may use a thin mixture of Type II or Type IV fluid when Type I or Type III fluid is not available.

Note: Holdover time starts when the final application begins in either the one step or two step procedure.

Forced Air Deicing

At some stations, forced air deicing equipment is used to facilitate contamination removal. Forced air deicing utilizes an air stream to help remove frozen accumulations from an aircraft with or without deicing fluid. Forced air deicing has the advantage of reducing the total amount of glycol needed for deicing, providing economic and environmental benefits. Forced air only (without fluid) may be especially helpful for removing frozen accumulations from RON aircraft surfaces.

Forced air applications (with or without fluid) may not eliminate the need for conventional de/anti-icing procedures. After a forced air application has occurred, conventional deicing (using fluid only) may be needed to ensure complete contamination removal.

Holdover times are not associated with forced air deicing. To use Type I holdover time tables, anti-icing using heated Type I fluid without forced air must occur. To use Type II, Type III, or Type IV holdover time tables, anti-icing using Type II, Type III, or Type IV fluid without forced air must occur.

The post-de/anti-icing check and report (below) should still occur even if forced-air deicing is the only task performed.

Copyright © Delta Air Lines, Inc. See title page for details.

De-/Anti-icing Checks

There are four types of de/anti-icing checks: Post De/Anti-icing Check, Flight Deck Check, Cabin Check, and External Check.

Post De/Anti-icing Check

This check is an integral part of the de/anti-icing process. After aircraft de/anti-icing is complete, the deicing ground crew performs a Post De/Anti-icing Check to confirm that the critical surfaces are free of any contamination. Confirmation that the Post De/Anti-icing Check has been successfully completed will be communicated to the pilots during the Post De/Anti-icing Report by stating; “POST DE/ANTI-ICING CHECK COMPLETE”.

Flight Deck Check

This check is an integral part of the holdover time and is performed by the pilots. Because of the limitations and cautions associated with the use of the Holdover Time Tables, the pilots must not rely on the use of holdover times as the sole determinant that the aircraft is free of contamination. They must continually assess the current weather, environmental conditions, and the aircraft’s condition. Several Flight Deck Checks are required during the holdover time period to maintain awareness of the aircraft’s condition.

The Flight Deck Check is performed by the pilots just prior to takeoff and is required anytime:

- Ground icing conditions exist, and
- The holdover time is still valid.

The Flight Deck Check consists of:

- A check of representative aircraft surfaces which are visible from the flight deck.
- If desired or if any doubt exists, conduct a Cabin Check.

When circumstances do not permit a satisfactory visual check from inside the aircraft, return to the designated area and:

- Have ground de-icing crew perform an External Check, or
- If any doubt exists as to the condition of the aircraft, repeat the Ground De/Anti-icing procedure.

Copyright © Delta Air Lines, Inc. See title page for details.

Cabin Check

This check is performed by the pilots and is required:

- Any time the aircraft has been de/anti-iced, and holdover time is exceeded during conditions of frost, freezing fog, or snow, or
- Within 5 minutes of takeoff any time a pilot-assessed change in intensity is to be used, or
- When doubt exists after conducting the Flight Deck Check, or
- During conditions of heavy snow (provided Type IV fluid has been used for anti-icing).

Since clear ice formation cannot be detected visually from inside the aircraft, the Cabin Check is not authorized when:

- Type I fluid has been applied during freezing drizzle.
- Type II , Type III, or Type IV fluid has been applied during freezing drizzle, light freezing rain, or rain on cold soaked wings and holdover time has expired. Secondary de/anti-icing or an External check must be accomplished prior to takeoff.
- Ice pellets have fallen.

The Cabin Check consists of a visual inspection of all representative aircraft surfaces which are visible from the best vantage point(s) in the cabin. Normally, de/anti-icing fluid failure will first occur on the leading or trailing edges of the wing rather than the mid-chord. Therefore, the leading edges and upper surfaces of both wings must be visually checked for evidence of fluid failure. Additionally, engine inlets must be inspected for contamination. Takeoff must occur within five minutes of the most recent check.

The ability to adequately perform this check from inside the aircraft is highly dependent upon several factors. Lighting conditions, cleanliness of cabin/flight deck windows, and outside visibility may severely hinder or prevent the pilot's ability to satisfactorily assess aircraft surfaces for contamination. When circumstances do not permit a satisfactory visual check from inside the aircraft, return to the designated area and:

- Have ground de-icing crew perform the External Check.
- If any doubt exists as to the condition of the aircraft, repeat the ground de/anti-icing procedure.

Copyright © Delta Air Lines, Inc. See title page for details.

External Check

This check is performed by the de/anti-icing ground crew and is required anytime:

- Doubt exists after conducting a Cabin Check, or
- The aircraft has been anti-iced with Type II, Type III, or Type IV fluid, and holdover time is exceeded during freezing drizzle, light freezing rain, or rain on cold soaked wings.

This check consists of a close visual inspection of the aircraft's upper wing surfaces and leading edges for frozen contamination. Takeoff must occur within five minutes of the External Check.

If the External Check cannot be accomplished, return for secondary de/anti-icing.

CAUTION: An External Check is not authorized during freezing drizzle when Type I fluid is used.

Contact local operations for specific locations on the airfield to accomplish the External Check. Be aware that some stations may conduct secondary de/anti-icing as an alternative to the External Check.

Visual Indications of Loss of Fluid Effectiveness

It is difficult to determine when anti-icing fluid is beginning to fail, however, when any ice or snow can be seen accumulating on treated surfaces, the fluid has lost its effectiveness. Any ice, frost, or snow on top of deicing or anti-icing fluids must be considered as adhering to the aircraft, and secondary de/anti-icing must be accomplished prior to takeoff.

- Normally, de/anti-icing fluid failure will first occur on the leading or trailing edges of the wing rather than the mid-chord. However, when the aircraft is pointing downwind the mid-chord will fail first.
- The leading edges and upper surfaces of both wings must be visually checked for evidence of fluid failure.
- If the leading edges and upper surfaces of both wings cannot be inspected from the cabin, return for an External Check or secondary de/anti-icing.

Type I Fluid

When Type I fluid has lost its effectiveness, frozen precipitation will begin to accumulate on the aircraft surface in much the same manner as it would on a nontreated surface.

Copyright © Delta Air Lines, Inc. See title page for details.

Type II, Type III, and Type IV Fluid

When Type II, Type III, or Type IV fluid has lost its effectiveness and is no longer able to absorb the freezing moisture, look for the following visual indications.

- Gray or white appearance and buildup of ice crystals in or on top of the fluid.
- Progressive surface freezing.
- Snow accumulation.
- Dulling of surface reflectiveness caused by the gradual deterioration of the fluid to slush (loss of gloss or orange peel appearance).
- Ice buildup on the wing life raft attach points (if installed), adjacent to the over-wing exits.

Copyright © Delta Air Lines, Inc. See title page for details.

TYPES OF DE/ANTI-ICING CHECKS

Type of Check	Post De/Anti-icing Check	Flight Deck Check	Cabin Check	External Check*
Performed by:	Deicing Ground Crew	Pilots	Pilots	Deicing Ground Crew
Required when:	The final fluid coating is applied to determine critical surfaces are free of frozen contamination.	Holdover time is still valid.	Doubt exists after the Flight Deck Check, **or** heavy snow is falling (provided Type IV fluid has been used for anti-icing), **or** holdover time is exceeded during conditions of frost, freezing fog, or snow, **or** snow grains.	Doubt exists after the Cabin Check, **or** Type II, Type III, or Type IV fluid has been used and holdover time is exceeded during conditions of freezing drizzle, light freezing rain, or rain on cold soaked wings.
Time limit to accomplish the check:	During/following the de/anti-icing and prior to pushback or taxi.	During the holdover time and just prior to takeoff.	Must be within five minutes of takeoff. Repeated as necessary.	Must be within five minutes of takeoff. Repeated as necessary.
Location to perform the check:	Outside the aircraft.	The flight deck (may also include the best vantage point(s) in the cabin).	The best vantage point(s) in the cabin.	Outside the aircraft.
Areas to check are:	Aircraft critical surfaces.	Representative surfaces visible from the flight deck (and cabin if desired).	All representative aircraft surfaces visible from the cabin.	Upper wing surface and leading edge.

* In lieu of external check, deicing ground crew may elect to de/anti-ice aircraft.

Copyright © Delta Air Lines, Inc. See title page for details.

Communication Procedures

Any airport specific deicing procedures will be contained in the Airway Manual, 10-0 Delta Special Pages (green pages), or noted in the Airport Remarks section of the flight plan.

It is critical to establish communications with the ground crew prior to commencing de/anti-icing. Once the deicing operation commences, any aircraft movement or changes in configuration must be coordinated with the ground crew.

Post De/Anti-icing Report

After the aircraft has been de/anti-iced, a Post De/Anti-icing Report must be directly communicated to the Captain using the format specified on the GROUND DE/ANTI-ICING procedure card. The pilot is required to read back this information to verify accuracy.

Note: A report is not required when the aircraft is deiced due to frost, prior to the pilot's arrival, and no active frost is forming.

Holdover Times

Use of Holdover Time Tables

Holdover times provide an operational guideline for departure planning. They must be used in conjunction with the Flight Deck Check. Holdover Time Tables are located in this section.

Holdover times published in the tables are only approximate and must be adjusted after considering all variables. The source of the Holdover Time Tables is the Aerospace Division of the Society of Automotive Engineers (SAE). Time data is derived from an analysis of testing conducted in field and laboratory conditions, as well as airline operational experience. Numerous factors affect the actual time that anti-icing fluid will provide protection against frozen contamination.

The times specified in the tables represent the approximate holdover times for seven categories of active precipitation.

- Frost.
- Freezing fog.
- Snow.
- Freezing drizzle.
- Freezing rain (light).

Copyright © Delta Air Lines, Inc. See title page for details.

- Ice pellets
- Rain on cold soaked wings.

Three precipitation categories specify a time range (snow, freezing drizzle, and rain on cold soaked wings), and four categories specify a single time (freezing fog, frost, light freezing rain and ice pellets).

Whenever a time range is given, the lower time in the range is for moderate precipitation conditions and the upper time is for light conditions.

When a single time is specified in the table, it represents the approximate holdover time limit for that weather condition. However, it may be necessary to adjust the holdover time downward after considering other environmental factors.

Establishing Holdover Time

A holdover time is established using the following five steps.

(1) Obtain the Post De/Anti-icing Report from the ground crew and read back the information. The following data from the report is used to establish a holdover time:
   - Fluid type: Type I, Type II, Type III, or Type IV.
   - Fluid concentration: Mixture information is only required for Type II, Type III, or Type IV fluid. There are no fluid mixture break outs on the Type I Holdover Time Table because dilution ratios do not significantly affect holdover time for Type I fluids.
   - Local time that the final (anti-icing) fluid application began. This is the point at which the holdover timing starts.

(2) Determine the current weather conditions (OAT, type of precipitation, and intensity of precipitation).
   - OAT is determined by the most current weather report or ATIS.
   - The Holdover tables allow pilots to determine holdover times based partly upon the type and intensity of the frozen precipitation that is falling.
   - The type and intensity of frozen precipitation (light, moderate, or heavy) is officially determined by the most current official weather report (e.g.,from National Weather Service [NWS], NWS-approved automated system, or other agent approved by the NWS).
   - If at any time a pilot assesses intensity **greater** than that being reported, he/she shall use the heavier precipitation when entering the holdover tables for holdover time.

Copyright © Delta Air Lines, Inc. See title page for details.

- If, in the pilot's judgement, the intensity is **less** than that being reported, the pilot shall request (e.g., to the tower or trained weather observer) a new observation be taken and reported or shall wait long enough for an update to an automated meteorological observation to be taken and reported as applicable.
    - A pilot may act on their own assessment of **lesser** precipitation intensity only in those cases concerning snowfall or ice pellets where the officially reported (e.g., from NWS, NWS-approved automated system, or other agent approved by the NWS) meteorological precipitation intensity is grossly different from that which is obviously occurring. (For example: precipitation is reported when there is no actual precipitation occurring.)
    - If an adjustment to intensity is pilot-assessed, the pilots shall communicate the newly assessed intensity to flight control via ACARS.
    - If a pilot acts based upon their own assessment that precipitation intensity levels are LOWER than the official reported intensity level, a Cabin Check is required within the 5 minutes preceding takeoff.
- Pilot assessment of precipitation intensity levels may only be used when there is enough natural sunlight or artificial lighting available to provide adequate exterior visibility. All windows through which the assessment is made must be adequately transparent so as to not restrict the pilot's visibility under the lighting conditions present.
- The Snowfall Intensities as a Function of Prevailing Visibility chart in the Flight Crew Operations Manual, Volume 1, is based on prevailing visibility and allowances are made for the effects of night light conditions.
- Ice pellet intensity shall be assessed using the following criteria:
    - Light - scattered pellets that do not completely cover exposed surfaces regardless of duration
    - Moderate - slow accumulation on the ground
    - Heavy - rapid accumulation on the ground
- Pilots are not permitted to self-assess intensity in the case of reported freezing drizzle or freezing rain unless no precipitation is actually falling. Freezing drizzle and freezing rain quickly adhere to cold surfaces and can be difficult to see; for this reason, if conditions are reported or anticipated the aircraft shall be de-iced and/or treated with anti-icing fluid as a precaution against encountering these conditions during taxi-out.

Copyright © Delta Air Lines, Inc. See title page for details.

(3) Based on all the information obtained in steps 1 and 2, reference the appropriate Holdover Time Table and determine:
- A single time from the frost, freezing fog, light freezing rain or ice pellets column, or
- A time range from the snow, freezing drizzle, or rain on cold soaked wings column.

(4) If a single time was extracted from the table, go to step 5. If a time range was extracted, determine a specific holdover time from this range by assessing:
- Intensity of precipitation. As a general rule, holdover time ranges should be interpreted as follows:
  - Light conditions = Upper end of time range.
  - Moderate conditions = Lower end of time range.
  - Heavy conditions = Less than the lower time value.
- When determining intensity, the pilots must consider the rate, density, and moisture content of the precipitation. For example, wet snow is considered more intense than dry/powdery snow and will have a lower holdover time. Wet snow occurs at or near freezing temperatures of -1°C (30°F) or above.

(5) Further refine the determined holdover time after considering the following additional factors:
- Environmental factors - Jet blast, high wind velocity, and wind direction may cause anti-icing fluid to flow off aircraft surfaces thus reducing holdover time. Blowing snow due to wind or jet blast could decrease holdover time by increasing the amount of precipitation contacting aircraft surfaces and diluting the fluid. Solar radiation from direct sunlight may increase holdover time by warming aircraft surfaces.
- Aircraft skin temperature - Although this is difficult to determine, pilots need to be aware that aircraft skin temperature lower than OAT may decrease holdover time. One of the best ways to assess wing skin temperature is by referencing the fuel temperature, if available. Fuel temperature significantly lower than OAT may decrease holdover time.
- Operational experience of the pilots - For example, pilots who rarely fly in ground icing conditions may feel more comfortable using more conservative holdover times. Additionally, any background knowledge or experiences can be applied by the pilots.

Copyright © Delta Air Lines, Inc. See title page for details.

Adjusting Holdover Time

A continuous assessment of weather and environmental conditions in conjunction with the Flight Deck Check is required during the holdover time period. Changing conditions may increase or decrease fluid effectiveness, necessitating a holdover time adjustment.

- A change in OAT.
- A change in type or intensity (rate or density) of precipitation. Snow changing to light freezing rain, or light snow changing to heavy snow will decrease holdover time. Conversely, moderate snow changing to light snow may increase holdover time. Presence of ice pellets precipitation may necessitate similar adjustment.
- Jet blast, an increase in wind velocity, or a change in wind direction will decrease holdover time.

Exceeding Holdover Time

The Captain is responsible for monitoring the status of the aircraft exterior for frozen contamination. The pilot performs periodic Flight Deck Checks to ensure the aircraft is free of contamination during the time between anti-icing and takeoff, whenever the holdover time is still valid.

When holdover time is exceeded, the required course of action will depend upon the type of active precipitation and the type of fluid used to anti-ice. Refer to the foldout card in this section for additional specific guidance.

Required Action When Holdover Time is Exceeded

<table>
<tr><th rowspan="2">Fluid Used to Anti-Ice</th><th colspan="6">Active Precipitation</th></tr>
<tr><th>Frost</th><th>Freezing Fog</th><th>Snow, Snow Grains</th><th>Freezing Drizzle</th><th>Light Freezing Rain</th><th>Rain on Cold Soaked Wings</th></tr>
<tr><td>Type I</td><td colspan="3" rowspan="2">Accomplish one of the following actions:
A Cabin Check,
An External Check, or
Secondary De/Anti-Icing</td><td colspan="3">Takeoff Not Authorized</td></tr>
<tr><td>Type II, Type III, or Type IV</td><td colspan="3">Accomplish one of the following actions:
An External Check, or
Secondary De/Anti-Icing</td></tr>
</table>

Copyright © Delta Air Lines, Inc. See title page for details.

Configuring the Aircraft for De/Anti-icing

It is the responsibility of the pilots to ensure the aircraft is properly configured prior to commencing de/anti-icing operations.

Note: Whenever de/anti-icing will occur during overnight parking, the pilots must ensure the aircraft is properly configured prior to leaving for the night. Refer to the Securing for Cold Weather procedure contained in this section.

Copyright © Delta Air Lines, Inc. See title page for details.

FOLD

Ground De–Icing/Anti–Icing

Before de/anti-icing:

Parking brake ..... Set

Ground personnel communications ..... Establish

Flaps ..... UP

Prevents ice and slush from accumulating in the flap cavities.

CAUTION: Snow/slush/ice ingestion in the APU inlet duct while the APU is running can cause serious damage. Coordinate with ground personnel to ensure that APU inlet area is clear before starting APU.

APU or external power ..... As required

PACK control switches ..... OFF

APU bleed air switch (APU running) ..... OFF

Reduces the possibility of fumes entering the air conditioning system.

Engine(s) (as required) ..... Shut down

WARNING: Once the deicing operation begins, any aircraft movement or changes in configuration must be coordinated with the ground crew.

After de/anti-icing:

Obtain and read back post de/anti-icing report.

Fluid type.

Concentration (for Type II, Type III, and Type IV only).

Local time final (anti-icing) fluid application began.

Verbal confirmation: “POST DE/ANTI-ICING CHECK COMPLETE”.

Reconfigure aircraft:

APU (if required) ..... ON

APU bleed air switch ..... AUTO

Do not use APU bleed air for pack operation for approximately 1 minute after de/anti-icing. Air conditioning smoke/fumes may result.

Engines (if required) ..... Restart

Run engines a minimum of 5 minutes with engine anti-ice on.

APU ..... OFF

PACK control switches ..... As required

Allow approximately 1 minute for residual fluid to drain prior to using packs.

Determine holdover time.

Use HOLDOVER TIME GUIDELINES table.

Holdover time starts when the final application of fluid begins.

Actual weather conditions could be different from reported conditions. The Captain makes the final determination using the most accurate of METAR, ATIS, or pilot observation. Refer to Icing in the Airway Manual, Weather chapter, Hazardous Weather section and the Snowfall Intensities as a Function of Visibility chart for additional information.

During taxi:

Flaps ..... Check, set as required

Consider delaying flap/slat extension when freezing precipitation or slush may accumulate on untreated surfaces, or when slush may accumulate in flap areas

Perform engine run-up as required:

When engine anti-ice is required and the OAT is 3°C or below, do an engine run up, as required, to minimize ice build-up. Use the following procedure:

Check that the area behind the airplane is clear.

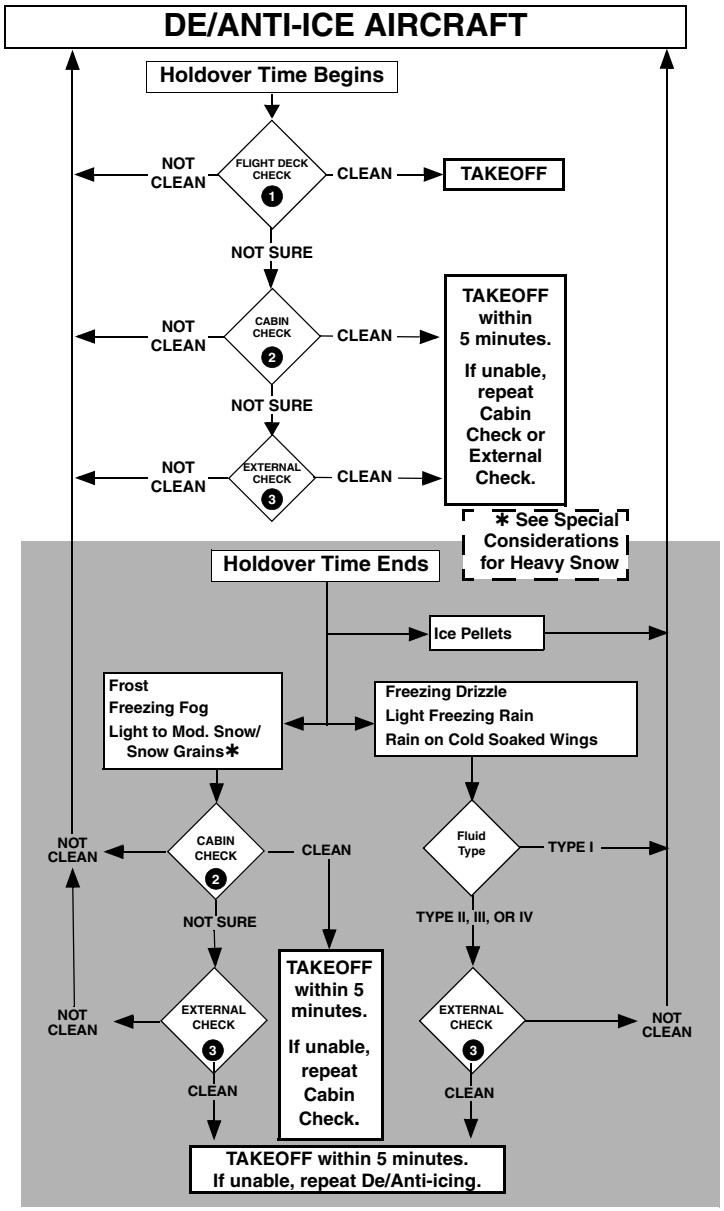
Interval	Min N1	Duration
45 Minutes	50%	1 second

Complete TAXI and BEFORE TAKEOFF checklists.

Note: For operations on contaminated runways, see the "Guidelines for Contaminated Runways" information at the end of this section.

Copyright © Delta Air Lines, Inc. See title page for details.

Takeoff Decision Tree



❶ Flight deck check

Inspect aircraft components visible from the flight deck for frozen contamination.

- Inspect the fuselage and radome.

❷ Cabin check

Inspect aircraft components visible from the cabin for frozen contamination.

Inspect all the following from the best vantage point in the cabin:

- Engine inlets.
- Both wings: upper surface and leading edge. (Best vantage points are the passenger windows forward of and at the overwing area. Use the wing illumination lights.)

❸ External check

Contact local operations.

- Secondary de/anti-icing may be performed in lieu of EXTERNAL CHECK.

Holdover Time Guidelines (All Locations & Fluid Types)

- Holdover times DO NOT exist for conditions of snow pellets, heavy snow, moderate to heavy freezing rain, or hail, and takeoff is NOT authorized under these conditions. An exception for heavy snow might be possible when Type IV anti-icing fluid is used; see Special Considerations for Heavy Snow.
- Holdover time ranges are for moderate to light conditions. During heavy weather conditions, the holdover time will be less than the lower time specified in the range.
- Jet blast, high wind velocity, high moisture content, and aircraft skin temperature lower than OAT may decrease holdover time below the lowest time specified in the range.
- Ground de-/anti-icing fluids are not intended for and do not provide ice protection during flight.
- For shaded areas either the holdover times have not been established or the weather conditions generally do not occur within the respective temperature range.
- These tables are for use in departure planning only, and should be used in conjunction with the pre-takeoff Flight Deck check.

Continued on next page

Copyright © Delta Air Lines, Inc. See title page for details.

Continued from previous page

◆ Special Considerations for Ice Pellets

Ice pellets generally remain in the frozen state, imbedded in anti-icing fluid, and are not absorbed by fluid in the same manner as other forms of frozen precipitation. In the past, presence of a contaminant not absorbed by the fluid would be an indication of a failed fluid. Ice pellets imbedded in anti-icing fluid are difficult to detect using a cabin check. Therefore, a cabin check during ice pellet conditions may not be of value and is not required.

Use of Holdover Time Tables for Ice Pellets and Ice Pellet Mixtures

After proper deicing and anti-icing, takeoff is allowed under conditions of light ice pellets, moderate ice pellets, and ice pellets mixed with other forms of precipitation by using the "Ice Pellet Holdover Times" table and accompanying footnotes. If the holdover time has been exceeded, the aircraft must be completely deiced, and if precipitation is still present, anti-iced again prior to a subsequent takeoff. The ice pellet holdover time cannot be extended by a cabin check or an external check of the aircraft critical surfaces.

❄ Special Considerations for Heavy Snow

Takeoffs are allowed in heavy snow provided:

- The aircraft has been anti-iced with 100% concentration Type IV fluid following deicing, and
- A Cabin Check is accomplished within the 5 minutes preceding takeoff

If a definitive fluid failure determination cannot be made using this check due to snowfall, lighting conditions, or any other reason, the aircraft must be completely deiced and anti-iced (if precipitation is still present) prior to takeoff.

Copyright © Delta Air Lines, Inc. See title page for details.

FOLD

Ice Pellet Holdover Times (100% Type IV Fluid Only)

OAT		HOLDOVER TIMES (MINUTES)					
				LIGHT ICE PELLETS MIXED WITH:			
°C	°F	LIGHT ICE PELLETS ONLY	MODERATE ICE PELLETS ONLY	LT-MOD SNOW	LT-MOD FREEZING DRIZZLE	LT FREEZING RAIN	LT RAIN
≥ 0	≥ 32	50	25	25	25	25	25
< 0 to -5	< 32 to 23	50	25	25	25	25	
< -5 to -10	< 23 to 14	30	10		10	10	
< -10	< 14	30	10	NOT AUTHORIZED			

Holdover times begin at the start of the anti-icing application.

Ice pellet holdover times are valid provided:

- Undiluted (100%) Type IV fluid is used for anti-icing.
- Critical surfaces are free of contamination before applying Type IV anti-icing fluid (i.e., ice pellets cannot be falling during either the deice or anti-ice steps).
- The table's precipitation intensity and temperature limits are not exceeded.

Type IV anti-icing fluid is considered effective for 90 minutes after the start of application, under the following conditions:

- If precipitation stops falling at any time during the holdover period, and
- the holdover time has not been exceeded, and
- the OAT has not decreased.

If precipitation resumes, the original holdover time must not be exceeded.

- If the temperature decreases, or conditions degrade to a point where a different holdover time would apply, that different holdover time must not be exceeded (from the start of the anti-icing step).

Copyright © Delta Air Lines, Inc. See title page for details.

Conversions

RVR Feet	RVR Meters	Statute Miles
6000	2000	1-1/4
5000	1600	1
4000	1200	3/4
2400	800	1/2

Snowfall Intensities as a Function of Prevailing Visibility

Time of Day	OAT °C	OAT °F	Visibility (Statute Mile) > 2½	< 2½ - 2	< 2 - 1½	< 1½ - 1	< 1 - ¾	< ¾ - ½	< ½	Snowfall Intensity
Day	> -1	> 30	Very Light	Light	Light	Moderate	Moderate	Heavy	Heavy	
	≤ -1	≤ 30	Very Light	Very Light	Light	Light	Moderate	Moderate	Heavy	
Night	> -1	> 30	Very Light	Light	Moderate	Heavy	Heavy	Heavy	Heavy	
	≤ -1	≤ 30	Very Light	Light	Moderate	Moderate	Heavy	Heavy	Heavy	

TYPE I

OAT °C	OAT °F	APPROXIMATE HOLDOVER TIMES (MINUTES) ACTIVE FROST	FREEZING FOG	SNOW/SNOW GRAINS ❋ VERY LIGHT	SNOW/SNOW GRAINS ❋ LIGHT	SNOW/SNOW GRAINS ❋ MODERATE	FREEZING DRIZZLE	LIGHT FREEZING RAIN	RAIN ON COLD SOAKED WING
≥ -3	≥ 27	45	11	18 - 22 ◆◆	11 - 18 ◆◆	6 -11 ◆◆	TAKEOFF NOT AUTHORIZED		
< -3 to -6	< 27 to 21	45	8	14 - 17 ◆◆	8 - 14 ◆◆	5 - 8 ◆◆			
< -6 to -10	< 21 to 14	45	6	11 - 13 ◆◆	6 - 11 ◆◆	4 - 6 ◆◆			
< -10	< 14	45	5	7 - 8 ◆◆	4 - 7 ◆◆				

◆◆ To use these times the fluid must be heated to a minimum temperature of 60°C (120°F) at the nozzle and at least 1 liter per square meter (2 gallons per 100 square feet) must be applied to de-iced surfaces.

* Refer to "Snowfall Intensities as a function of Prevailing Visibility" chart if no other environmental factors inhibiting visibility, i. e., smoke or fog, are present.

Holdover times DO NOT exist for conditions of ice pellets, snow pellets, heavy snow, freezing drizzle, freezing rain, or hail, and takeoff is NOT authorized under these conditions.

TYPE IV

OAT °C	OAT °F	Fluid Concentration (Fluid/Water)	APPROXIMATE HOLDOVER TIMES (MINUTES) ACTIVE FROST	FREEZING FOG	SNOW/SNOW GRAINS* MOD - LGT	SNOW/SNOW GRAINS* HEAVY	ICE PELLETS ◆	FREEZING DRIZZLE** MOD - LGT	LIGHT FREEZING RAIN	RAIN ON COLD SOAKED WING† MOD - LGT
≥ -3	≥ 27	100/0	12 hrs	75	35-75	❄	See Ice Pellets Holdover Times Table	40-70	25	10-50
		75/25	5 hrs	65	20-55			35-50	15	5-35
		50/50	3 hrs	15	5-15			10-20		
< -3 to -10	< 27 to 14	100/0	12 hrs	20	20-40	❄		20-45	10	
		75/25	5 hrs	25	15-35			15-30	10	
< -10 to -14	< 14 to 7	100/0	12 hrs	20	20-40	❄		TAKEOFF NOT AUTHORIZED		
		75/25	5 hrs	25	15-35					
< -14 to -25	< 7 to -13	100/0	12 hrs	15	15-30	❄				
< -25	< -13	USE TYPE I FLUID								

† Use only for 0° C (32° F) or above.

* Refer to "Snowfall Intensities as a function of Prevailing Visibility" chart if no other environmental factors inhibiting visibility, i. e. smoke or fog, are present.

** If positive identification of freezing drizzle is not possible, use light freezing rain holdover times.

❄ Takeoffs are allowed in heavy snow provided:
(1) the aircraft has been anti-iced with 100/0 concentration Type IV fluid following deicing, and
(2) a pre-takeoff contamination (cabin) check is accomplished within the 5 minutes preceding takeoff.
If a definitive fluid failure determination cannot be made using this check due to snowfall, lighting conditions, or any other reason, the aircraft must be completely deiced and anti-iced (if precipitation is still present) prior to takeoff.

◆ Refer to Ice Pellets Holdover Times table in this section.

Type II and Type III Fluid Holdover Times Tables

TYPE II									
OAT		FLUID CONCENTRATION (FLUID/WATER	APPROXIMATE HOLDOVER TIME (MINUTES)						
°C	°F		ACTIVE FROST	FREEZING FOG	SNOW/ SNOW GRAINS*	FREEZING DRIZZLE**	LIGHT FREEZING RAIN	RAIN ON COLD SOAKED WING†
					MOD - LGT	MOD - LGT		MOD - LGT
≥ -3	≥ 27	100/0	8 hrs	35	20 - 45	30 - 55	15	5 - 40
		75/25	5 hrs	25	15 - 30	20 - 45	10	5 - 25
		50/50	3 hrs	15	5 - 15	5 - 15	TAKEOFF NOT AUTHORIZED	TAKEOFF NOT AUTHORIZED
< -3 to -10	< 27 to 14	100/0	8 hrs	20	15 - 30	15 - 45	10	TAKEOFF NOT AUTHORIZED
		75/25	5 hrs	20	10 - 20	15 - 30	TAKEOFF NOT AUTHORIZED	TAKEOFF NOT AUTHORIZED
< -10 to -14	< 14 to 7	100/0	8 hrs	20	15 - 30	TAKEOFF NOT AUTHORIZED	TAKEOFF NOT AUTHORIZED	TAKEOFF NOT AUTHORIZED
		75/25	5 hrs	20	10 - 20	TAKEOFF NOT AUTHORIZED	TAKEOFF NOT AUTHORIZED	TAKEOFF NOT AUTHORIZED
< -14 to -25	< 7 to -13	100/0	8 hrs	15	15 - 30	TAKEOFF NOT AUTHORIZED	TAKEOFF NOT AUTHORIZED	TAKEOFF NOT AUTHORIZED
< -25	< -13	USE TYPE I FLUID						

* Refer to "Snowfall Intensities as a function of PrevailingVisibility" chart if no other environmental factors inhibiting visibility, i. e., smoke or fog, are present.

** If positive identification of freezing drizzle is not possible, use light freezing rain holdover times.

† Use only for 0°C (32°F) or above.

Holdover times DO NOT exist for conditions of ice pellets, snow pellets, heavy snow, moderate to heavy freezing rain, or hail, and takeoff is NOT authorized under these conditions.

Copyright © Delta Air Lines, Inc. See title page for details.

TYPE III										
OAT		FLUID CONCENTRATION (WATER/FLUID)	APPROXIMATE HOLDOVER TIMES (MINUTES)							
°C	°F		ACTIVE FROST	FREEZING FOG	SNOW/SNOW GRAINS *			FREEZING DRIZZLE **	LIGHT FREEZING RAIN	RAIN ON COLD SOAKED WING†
					VERY LIGHT	LIGHT	MODERATE			
≥ -3	≥ 27	100/0	120	20	35 - 40	20 - 35	10 - 20	10 - 20	8	6 - 20
		75/25	60	15	25 - 35	15 - 25	8 - 15	8 - 15	6	
		50/50	30	10	15 - 20	8 - 15	4 - 8	5 - 9		
< -3 to -10	< 27 to 14	100/0	120	20	30 - 35	15 - 30	9 - 15	10 - 20	8	
		75/25	60	15	25 - 30	10 - 25	7 - 10	9 - 12	6	
< -10 to -29	< 14 to -20	100/0	120	20	30 - 35	15 - 30	8 - 15	TAKEOFF NOT AUTHORIZED		
< -29	< -20	**USE TYPE I FLUID**								

† Use only for 0° C (32° F) or above.

* Refer to "Snowfall Intensities as a function of PrevailingVisibility" chart if no other environmental factors inhibiting visibility, i. e., smoke or fog, are present.

** If positive identification of freezing drizzle is not possible, use light freezing rain holdover times.

Copyright © Delta Air Lines, Inc. See title page for details.

Hot Weather Operation

During extended ground operations prior to flight deck preparation, consideration should be given to reducing the heat being generated on the flight deck. Window heat, radar, and other electronic components which contribute to a high temperature level on the flight deck should be turned off. All the flight deck air outlets should be open.

If a ground source of conditioned air is available, the supply should be used immediately after engine shutdown and should not be removed until either the APU or the engines are started.

If a ground source of conditioned air is not available, both packs should be used and recirculation fans should be on for maximum cooling.

To maximize the cooling capacity of the air conditioning system, the flight deck side windows and all doors, including cargo doors, should be kept closed as much as possible. All gasper outlets should be open and window shades on the hot (sun–exposed) side of the passenger cabin should be closed. Flight deck cooling can be improved by closing the flight deck door and lowering the side trays adjacent to the pilot seats.

Note: If only cooling air from ground air conditioning cart is supplied (no pressurized air from the APU or ground external air), then the TAT probe is not aspirated. Because of high TAT probe temperatures, the FMCs may not accept an assumed temperature derate. Delay selecting an assumed temperature derate until after bleed air is available.

Moderate to Heavy Rain, Hail or Sleet

Flight should be conducted to avoid thunderstorms, hail activity or visible moisture over storm cells. To the maximum extent possible, moderate to heavy rain, hail or sleet should be avoided.

Copyright © Delta Air Lines, Inc. See title page for details.

Severe Turbulence

The turbulent air penetration speed provides ample protection from stall and high speed buffet, while also providing protection from exceeding the structural limit.

The recommended procedures for flight in severe turbulence are summarized below:

SEAT BELT sign selector ..... ON

Advise passengers to fasten seatbelts prior to entering areas of reported or anticipated turbulence. Instruct flight attendants to check all passengers' seat belts are fastened.

Structural Considerations

Flap extension in an area of known turbulence should be delayed as long as possible because the airplane can withstand higher gust loads in the clean configuration. Diversion to another airfield is recommended if severe turbulence persists in the area.

Climb, Cruise, and Descent Considerations

After takeoff, and when established in a clean climb configuration, use of the autoflight system is recommended for flight through turbulence.

During climb and descent, use of VNAV or flight level change may result in excessive pitch changes as the AFDS attempts to fly speed with the elevators. Therefore, vertical speed mode (speed on autothrottles) is recommended for climb and descent in severe turbulence.

During cruise, VNAV and altitude hold modes both fly speed on autothrottles and can be used in turbulence.

Ships 7101 & Subsequent

In severe turbulence during cruise, it may be necessary to disconnect the autothrottles to prevent excessive thrust changes. Thrust setting guidance is available on EICAS when VNAV is engaged. Set N1 at or slightly above the magenta VNAV target N1 indication. Change thrust setting only if required to modify an unacceptable speed trend.

Copyright © Delta Air Lines, Inc. See title page for details.

Ships 7001 – 7008

In severe turbulence during cruise, it may be necessary to disconnect the autothrottles to prevent excessive thrust changes. Thrust setting guidance is available on EICAS when VNAV is engaged. Set EPR at or slightly above the magenta VNAV target EPR indication. Change thrust setting only if required to modify an unacceptable speed trend.

Manual Flight in Severe Turbulence

If manual flight in severe turbulence becomes necessary, trim the airplane for the turbulent air penetration speed. Control the airplane pitch attitude with the elevators using the attitude indicator as the primary instrument. In extreme drafts, large altitude changes may occur. Do not make sudden large control inputs. Corrective actions to regain the desired attitude should be smooth and deliberate. Altitude variations are likely in severe turbulence and should be allowed to occur if terrain clearance is adequate. Control airplane attitude first, then make corrections for airspeed, altitude, and heading.

Windshear

Windshear is a change of wind speed and/or direction over a short distance along the flight path. Indications of windshear are listed in the Non-Normal Maneuvers section in this manual.

Avoidance

The flight crew should search for any clues to the presence of windshear along the intended flight path. Presence of windshear may be indicated by:

- Thunderstorm activity
- Virga (rain that evaporates before reaching the ground)
- Pilot reports
- Low level windshear alerting (LLWAS) warnings

Stay clear of thunderstorm cells and heavy precipitation and areas of known windshear. If the presence of windshear is confirmed, delay takeoff or do not continue an approach.

Continued on next page

Copyright © Delta Air Lines, Inc. See title page for details.

Continued from previous page

Precautions

If windshear is suspected, be alert to any of the danger signals and be prepared for the possibility of an inadvertent encounter. The following precautionary actions are recommended if windshear is suspected:

Takeoff

- Use maximum takeoff thrust instead of reduced thrust.
- Use the longest suitable runway provided it is clear of areas of known windshear.
- Use the flight director after takeoff.
- Consider increasing Vr speed to the performance limited gross weight rotation speed, not to exceed actual gross weight Vr+20 knots. Set V speeds for the actual gross weight. Rotate at the adjusted (higher) rotation speed. This increased rotation speed results in an increased stall margin, and meets takeoff performance requirements. If windshear is encountered at or beyond the actual gross weight Vr, do not attempt to accelerate to the increased Vr, but rotate without hesitation.
- Be alert for any airspeed fluctuations during takeoff and initial climb. Such fluctuations may be the first indication of windshear.
- Know the all-engine initial climb pitch attitude. Rotate at the normal rate to this attitude for all non-engine failure takeoffs. Minimize reductions from the initial climb pitch attitude until terrain and obstruction clearance is assured, unless stick shaker activates.
- Crew coordination and awareness are very important. Develop an awareness of normal values of airspeed, attitude, vertical speed and airspeed build-up. Closely monitor vertical flight path instruments such as vertical speed and altimeters. The pilot monitoring should be especially aware of vertical path instruments and call out any deviations from normal.
- Should airspeed fall below the trim airspeed, unusual control column forces may be required to maintain the desired pitch attitude. Stick shaker must be respected at all times.

Approach and Landing

- Use either Flaps 30 for landing.
- Establish a stabilized approach no lower than 1000 feet above the airport to improve windshear recognition capability.

Copyright © Delta Air Lines, Inc. See title page for details.

- Use the most suitable runway that avoids the areas of suspected windshear and is compatible with the crosswind or tailwind limitations. Use ILS G/S, VNAV path or VASI/PAPI indications to detect flight path deviations and help with timely detection of windshear.
- If the autothrottle is disengaged, or is planned to be disengaged prior to landing, add an appropriate airspeed correction (correction applied in the same manner as gust), up to a maximum of 20 knots.
- Avoid large thrust reductions or trim changes in response to sudden airspeed increases as these may be followed by airspeed decreases.
- Crosscheck flight director commands using vertical flight path instruments.
- Crew coordination and awareness are very important, particularly at night or in marginal weather conditions. Closely monitor the vertical flight path instruments such as vertical speed, altimeters and glide slope displacement. The pilot monitoring should call out any deviations from normal. Use of autopilot and autothrottle for the approach may provide more monitoring and recognition time.

Recovery

Accomplish the WINDSHEAR ESCAPE MANEUVER found in the Non-Normal Maneuvers section of the Quick Reference Handbook.

Guidelines For Contaminated Runways

When there is contamination on the runway or the braking action is less than good, Captains must evaluate crew, aircraft, and environmental conditions in determining the safety of operating their flight.

For takeoffs, refer to Flight Operations Manual, Chapter 5, Flight Planning, Weight Data Record (WDR), Contaminated Runways for additional guidance.

Refer to the Airway Manual, Chapter 4 (“Weather”) for Braking Action Report discussion.

Procedure Guidance

General

- Consider crew capability.
- Consider current Maintenance Carry Overs (MCOs) - reversers, antiskid, etc.
- Consider type and amount of contaminant.

Continued on next page

Copyright © Delta Air Lines, Inc. See title page for details.

Continued from previous page

- Consider source and age of reported braking action.
- Consider usable runways and taxiways (NOTAMS, ATIS, etc.).

Taxi

- Be aware that ramps and taxiways may be very slippery.
- Be cautious of jetblast on contaminated surfaces. People and equipment behind may be in jeopardy.
- Taxi onto and off runways at an extremely slow speed. Nose wheel slippage may occur causing the aircraft to continue straight ahead and possibly off the paved surface.

Crosswind

- On slippery runways, crosswind guidelines are a function of runway surface condition, airplane loading, and assume proper pilot technique.
- The following crosswind guidelines are applicable to all Delta aircraft for takeoff and landing.

Braking Action	Crosswind Limit	Tailwind Limit
Good	Aircraft Limits	10 kts*
Fair	20 kts	5 kts
Poor	10 kts	0 kts
Nil	Do Not Operate	

* Unless the aircraft and airport are authorized to 15 kts.

Notes:

- Crosswind guidelines are not considered limitations. Refer to AOM Volume 1, Limitations chapter for crosswind limits.
- Reduce crosswind guidelines by 5 knots with a reverser inoperative.
- When multiple reports are present, e.g. "Braking Action Fair to Good", use the lower crosswind value.

Takeoff

- Do not take off with braking action report of NIL by any air carrier aircraft or airport operator.
- A rolling takeoff is strongly advised when the crosswind exceeds 20 knots.
- Do not take off with standing water, slush, or wet snow in excess of 1/2 inch (1.2 cm) depth.
- Do not take off in dry snow in excess of 4 inches or 10 cm depth.

Copyright © Delta Air Lines, Inc. See title page for details.

Landing

- Do not land with a braking action report of NIL by any air carrier aircraft or airport operator in the landing or rollout portion of the runway.
- Do not land with standing water, slush, or wet snow in excess of 1 inch (2.5 cm) depth.
- Do not land in dry snow in excess of 4 inches or 10 cm depth.
- Land as early in the touchdown zone as possible.
- Ensure the ground spoilers are extended at touchdown.

- Use autobrakes, if available.
- Use reverse thrust judiciously.
- Do not assume the last 2,000 feet of the runway will have braking action as good as the touchdown zone.
- Be aware of the possibility of white out effect from reverse thrust use in dry snow.

Copyright © Delta Air Lines, Inc. See title page for details.

Intentionally
Blank

Copyright © Delta Air Lines, Inc. See title page for details.

Copyright © The Boeing Company. See title page for details.

Intentionally
Blank

Copyright © The Boeing Company. See title page for details.

Airplane General, Emergency Equipment, Doors, Windows

Item	777-232ER (7001-7007)	777-232ER (7008)	777-232LR (7101 & Subsequent)
Door 1 Upper Crew Rest Compartment	Single panel door Above 25,000 feet, 2 crewmembers may occupy the Door 1 rest compartment. Below 25,000 feet, no crewmember may occupy the Door 1 rest compartment.		Bifold door During all phases of flight (including taxi, takeoff and landing), 2 crewmembers may occupy the Door 1 rest compartment.
Door 3 Upper Crew Rest Compartment	Above 25,000 feet, 6 crewmembers may occupy the Door 3 rest compartment. Below 25,000 feet, no crewmember may occupy the Door 3 rest compartment.		Not installed
Door 4 Upper Crew Rest Compartment	Not installed		Above 25,000 feet, 6 crewmembers may occupy the Door 4 rest compartment. Below 25,000 feet, no crewmember may occupy the Door 4 rest compartment.
Emergency Equipment	Refer to Emergency Equipment Location charts in Volume 2		
Emergency Evacuation Signal System	Installed		Not installed
Emergency Locator Transmitter (ELT)	Two portable units, one in flight deck, one in cabin.		One permanently mounted in top center of fuselage with switch installed on overhead panel in flight deck. One portable unit in cabin.
Medical Outlet Power Switch	Installed, switch on overhead maintenance panel in flight deck.		Not installed

Copyright © The Boeing Company. See title page for details.

Item	777-232ER (7001-7007)	777-232ER (7008)	777-232LR (7101 & Subsequent)
Cabin Crew Notification	NO SMOKING selector		CABIN CHIME switch
Flight Deck Door Access System Switch	Not installed		Installed (on side flight deck door post)
Flight Deck Door Locking Mechanism	Mechanical Latch Pin		Deadbolt
Flight Deck Door Lock Panel Location	Overhead panel		Aft aisle stand
Maximum Weights	See Limitations chapter.		
Wing Tip Radius	144.9 feet		152.5 feet
Wingtips	Conventional		Raked Tip

Air Systems

Item	777-232ER (7001-7007)	777-232ER (7008)	777-232LR (7101 & Subsequent)
APU to Pack Takeoff	Not installed		Installed

Communications

Item	777-232ER (7001-7007)	777-232ER (7008)	777-232LR (7101 & Subsequent)
Cockpit Voice Recorder (CVR) Test Indicator	Meter		Light
Cabin Medical Communication System	Not installed		Installed
Second Observer's Audio Panel	Not installed		Installed next to second observer's seat

Copyright © The Boeing Company. See title page for details.

Electrical

Item	777-232ER (7001-7007)	777-232ER (7008)	777-232LR (7101 & Subsequent)
In-flight Entertainment System/Passenger Seats Power Switch	Not installed	Installed (overhead ELECTRICAL panel)	
Cabin Utility Power Switch	Not installed	Installed (overhead ELECTRICAL panel)	

Engines, APU

Item	777-232ER (7001-7007)	777-232ER (7008)	777-232LR (7101 & Subsequent)
Engine Type	Rolls Royce Trent 895		General Electric GE90-110B1
Simultaneous Engine Starting	Available		Not Available
Takeoff Thrust Bump Reference Mode	Not installed		Installed

Flight Controls

Item	777-232ER (7001-7007)	777-232ER (7008)	777-232LR (7101 & Subsequent)
Tailstrike Protection	Not installed		Installed

Flight Instruments, Displays

Item	777-232ER (7001-7007)	777-232ER (7008)	777-232LR (7101 & Subsequent)
Standby Instruments	Three separate standby instruments		One integrated standby instrument

Copyright © The Boeing Company. See title page for details.

Fuel

Item	777-232ER (7001-7007)	777-232ER (7008)	777-232LR (7101 & Subsequent)
Center Fuel Pump Shutoff	Manual shutoff		Automatic shutoff when center tank is empty
Fuel Tank Quantities	See Limitations chapter.		
Center Tank Fuel Pump Operation	Operate normally		Takeoff Restrictions (see Normal Climb Procedures)

Landing Gear

Item	777-232ER (7001-7007)	777-232ER (7008)	777-232LR (7101 & Subsequent)
Tire Pressure Indication	Not installed		Installed

Copyright © The Boeing Company. See title page for details.